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Name of Author: Scot Hamish Simpson, B.S.P., Pharm.D.

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"The desire to take medicine is perhaps the greatest feature which distinguishes man from animals."

– Sir William Osler, 1891

University of Alberta

Development and initial testing of a new instrument to identify patient-perceived barriers to medication use in patients with congestive heart failure

by

Scot Hamish Simpson, B.S.P., Pharm.D. ©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements of the degree of Master of Science

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled "Development and initial testing of a new instrument to identify patient-perceived barriers to medication use in patients with congestive heart failure" submitted by Scot Hamish Simpson, B.S.P., Pharm.D. in partial fulfillment of the requirements for the degree of Master of Science in Experimental Medicine.

Abstract

The overall objective of this study was to develop and test the measurement properties of a questionnaire that would facilitate identification of patient-perceived barriers to medication use in patients with congestive heart failure.

Twenty-six patients with heart failure provided items for the questionnaire through their participation in a series of focus group sessions. The completed questionnaire has 31 items and takes approximately 10 minutes for the patient to complete.

Testing of the instrument involved 114 consecutive patients attending an ambulatory heart failure clinic. Initial results suggest this instrument has reasonable internal consistency reliability and stability. Preliminary data supports the principle underlying construct that patients with good adherence perceive few barriers to medication use. Further testing of this instrument's measurement properties in other patient groups is warranted.

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Chapter 1

Introduction

1.1.0 Statement of the Problem

Congestive heart failure (CHF) is the final common pathway for numerous cardiovascular diseases.[1] This is a complex clinical syndrome used to describe an abnormality that inhibits the heart's ability to eject sufficient blood to meet the body's demands.[2,3] The prominent symptoms of CHF are dyspnea, fatigue, and fluid retention, which can severely limit the functional capacity and quality of life of patients with CHF. A second feature of this syndrome is the progression of symptoms due to continued deterioration of the heart tissue.[4] This results in a continued and often increasing need for hospitalization and further medical attention.[3]

It is estimated that CHF is present in 2% to 3% of the adult population aged 25-75 years.[5] The prevalence of CHF increases with age with 4% to 6% of those aged 65 years and older affected. The syndrome of CHF is associated with high mortality and morbidity. After diagnosis, the median survival is 1.7 years in men and 3.2 years in women.[6] This mortality rate increases with age and severity of disease.[6] Congestive heart failure is the leading cause of hospitalization in those over the age of 65 years.[7] Despite significant advances in the understanding of the pathophysiology[4,8] and treatment[3] of CHF, the incidence and prevalence of this disease (and hence the burden of illness) is increasing.[5,9]

Numerous agents have demonstrated a benefit in reducing mortality due to CHF. For example, angiotensin converting enzyme (ACE) inhibitors are recommended as first line agents in the management of CHF because they significantly reduce the risk of

mortality and hospitalization.[2,3] The addition of beta adrenergic receptor blockers to standard ACE inhibitor and diuretic therapy provides further reductions in morbidity and mortality.[3,10] Recent evidence supports the blockade of aldosterone receptors through the use of spironolactone.[11] The use of these agents is increasing, especially in ambulatory management of CHF.[5,12,13]

In general, when patients are prescribed long-term therapies, it is estimated that 50% will be non-adherent after one year.[14] Compliance (or adherence) is defined as the extent to which a patient follows medical advice.[15] Poor adherence to medication regimens is associated with poor outcomes in patients with cardiovascular disease.[16] Interestingly, adherence to placebo in some clinical trials was associated with reduced morbidity and mortality.[17,18,19]

Poor adherence is also a major concern in CHF. One study in CHF reported that only 10% of 7247 patients obtained sufficient refills to have a daily supply of medication for one year.[20] Poor adherence to prescribed therapies is a leading preventable cause of treatment failure leading to exacerbation of CHF symptoms and hospitalization.[21-26] Furthermore, poor adherence could lead to inaccurate assessments of therapy, which could result in inappropriate adjustments to medications.[27]

Medication adherence is a complex human behaviour and several theories have been proposed to help clinicians understand it. The Health Belief Model suggests that patients will take a course of action if they believe the benefits outweigh potential barriers.[28] Within the constructs of this model, patients will adhere to a recommended therapy if they believe the threat of illness will be reduced by that therapy. When making their decision to adhere to therapy patients will consider their perceived susceptibility to

and severity of the illness, the potential benefits of the therapy, and barriers to its use.[29,30] By far, the most powerful element within the Health Belief Model for predicting adherent behaviour is the perception of barriers.[29]

Patients with CHF report several factors that limit their ability to take efficacious medications for their disease.[31,32] These barriers can be grouped into five general categories. First, the patient's relationship with their healthcare provider can have a profound influence on the degree to which they take advice.[32,33] Second, use of terms that the patient cannot understand will limit the patient's ability to use any information the healthcare provider gives.[32] Third, previous experiences with medications, such as adverse drug events, cost, and lack of perceived effect influence the patient's trust in the medication regimen.[31,32] Fourth, a lack of coping mechanisms, such as support from close family and friends may reduce the patient's ability to continue with long-term therapies.[32] Finally, patients who are unaware of the severity of their disease and the need for drug therapy are less likely to continue taking medications.[31,32]

It is well recognized that poor adherence is a major challenge for healthcare professionals.[34] In recent recommendations, the Expert Panel on Compliance recognized the need for a multilevel approach to identify patients at risk for non-adherence and implement strategies to improve adherence.[34] The most effective strategy involves a comprehensive intervention that fulfills the complex needs of the individual patient.[35,36] At the heart of this intervention should be the identification of patient-perceived barriers to medication use.

Although much work has been done to identify predictors of adherent behaviour[37,38], this research largely focuses on the outcome, rather than the motivating

factors.[34,39,40] Furthermore, early research was conducted within the paternalistic model of medical decision making, suggesting that poor adherence was completely the fault of the patient.[37,40] As healthcare moves towards increased patient participation in decisions, further insight into the factors that influence a patient's decision to adhere to therapy is needed.[39,40] Currently there are no instruments to help clinicians identify patient-perceived barriers to medication adherence in CHF.

1.2.0 Purpose

The purpose of this study was to gain an understanding of the factors that influence a patient's decision/ability to adhere to medications. Furthermore, this knowledge was applied in the development and evaluation of a new instrument to identify barriers to medication use. The specific objectives were to:

1. Identify and explore patient-perceived barriers to medication use in CHF patients.
2. Develop an instrument to help clinicians identify and quantify patient-perceived barriers to medication use.
3. Evaluate the relationship between perceived presence of barriers and patients' adherence.
4. Evaluate the psychometric properties of the new instrument.

1.3.0 Significance of the Study

Patients with congestive heart failure place a significant burden on the healthcare system. When patients are poorly adherent to efficacious therapies, they are at increased

risk of suffering poor outcomes. Improvement of adherence is a major challenge for patients and clinicians.

Several tools are available to assist the clinician in identifying patients with poor adherence. These tools include pill counting, patient report, refill records, and serum drug levels.[41] However, identification of the non-adherent patient does not ensure successful improvement of adherence. To meet the many needs of patients, interventions that successfully improve adherence must be multifaceted.[35,36] To be effective, an intervention program must be comprehensive and include combinations of patient education, drug regimen tailoring, communication enhancement, and support network improvement.[35,36,42] Efficacy is augmented when these elements are adjusted to the specific needs of the individual patient. The initial step in this process is a careful assessment of the actual or potential barriers that a patient faces when taking long-term medications. Identification of these barriers will help clinicians develop and implement strategies that will successfully improve a patient's adherence rate. This research process resulted in the development of an instrument to assist clinicians in the identification of barriers to medication use.

This research may be useful to clinicians and researchers in various practice settings. Although the instrument developed in this research was specific for CHF patients, it is likely that items generated during the initial stages are applicable to patients with other diseases. This instrument will be available for use in settings other than an ambulatory clinic. With the incorporation of a few disease-specific questions, this instrument may be used in other disease settings.

This research may also be useful to the healthcare system in general. The identification and successful reduction of barriers to medication use would likely result in improved patient outcomes[16,35,36] (although this hypothesis would need to be tested in a randomized controlled trial). Patients with good adherence would use fewer healthcare resources such as hospitals, emergency rooms, and physicians.[43-45] It should then follow that the economic burden of non-compliance would then be reduced.[45]

Chapter 2

Review of the Literature

2.1.0 Definition of Adherence

An accepted definition of compliance is "the extent to which a person's behaviour, in terms of taking medication(s), coincides with medical advice".[46] The term 'medication compliance' has undergone several translations and interpretations since the concept was introduced to healthcare in the 1970s. Although some authors use 'adherence' and 'compliance' interchangeably, these words have distinct characteristics and connotations.[27,34,37,47-50] Specific words used in the description of a phenomenon can have a powerful influence on the perception of that phenomenon. Under the ideology of compliance, research has defined poor compliance in terms of a patient failing to meet professional expectations, rather than exploring the concept of health-related behaviour.[37] The word 'compliance' is considered by some to have coercive and paternalistic connotations, leading to a search for less authoritative terms such as 'treatment adherence', 'therapeutic alliance', and 'concordance'.[48] In this document, the term '**adherence**' will be used in view of the preferred paradigm of patient-focussed care and the increased role of the patient in the decision making process.

2.2.0 Classification of Adherence / Non-Adherence

Adherence to medication can be complete, partial, erratic, or nonexistent. An adherence rate may be calculated by dividing the number of doses taken by the total prescribed doses during an interval. The traditional view of adherence often dichotomizes patients as adherent and non-adherent based on whether they are above or

below some predefined threshold adherence rate.[38] Some investigators divide patients based on the median adherence rate, classifying those above this level as "adherent" and those below, as "non-adherent".[51] However, this method leads to variability in the defined level of adherence, making comparisons between different studies difficult. Basing the cut-point on a statistical measure may also result in a level that is either clinically or behaviourally irrelevant.[41,51]

An alternative method is to view the adherence threshold in terms of a therapeutic outcome. Thus, a person with poor adherence uses too few doses to reach the desired preventive or therapeutic outcome.[41] A commonly accepted cut-point of 80% is based on studies reporting that patients who took at least 80% of their medication were more likely to achieve a normal blood pressure[52,53] and had a lower risk of mortality.[17] However, little is known about the minimum amount of medication required to achieve therapeutic benefits.

Recently, specific actions by the patient have been defined to provide a better conceptual framework for non-adherent medication behaviour.[45,54] A patient is considered non-adherent if they perform any of the following actions: 1) fail to have the prescription filled or refilled, 2) take too much or too little of the medication, 3) take the medication at erratic intervals or omit doses, 4) stop taking the medication too soon, 5) take medications that were not prescribed to them, 6) combine prescriptions with over-the-counter or illicit drugs, and 7) combine prescription medications with alcohol. An even broader view of the spectrum of adherence has been suggested, whereby poor adherence may extend as far back as to include those who do note even present for medical attention.[41]

2.3.0 Measurement of Adherence Rate

Regardless of the term and definition used to identify those with poor adherence, accurate measurement of medication use is essential to properly assess treatment effectiveness. An ideal standard has long been the "Holy Grail" for adherence measurement.[55] This ideal standard should be unobtrusive, objective, and practical; however, few methods available today possess all three characteristics. Of the methods available today, there is little agreement on which measure provides the most accurate estimate of a patient's medication use. Methods are divided into direct and indirect measurements of adherence (Table 2.1).[41]

Table 2.1 Methods to measure adherence rate

Direct	Blood Levels Urinary Excretion
Indirect	Therapeutic Response Clinician Impression Self-Report Residual Pill Count Electronic Event Monitor Computerized Medication Records

2.3.1 Direct Methods

Direct methods involve the measurement of a chemical in a body fluid. Serum, tissue, or urine samples are collected to measure levels of medication, metabolites, biological markers, or tracer molecules.[41,56] For example, a well-established and accepted marker of adherence to diabetic therapy is the glycosylated hemoglobin level.[57] Although direct methods are favoured for their objectiveness[56,58], there are several factors to be considered that may make them expensive and labour-intensive. First, a specific, biologically meaningful marker and sensitive reagents must be available to perform the

test. Second, elimination kinetics of the marker can affect test results and their interpretation. Direct measurement of a single blood sample does not account for intra-individual and inter-individual pharmacokinetic and pharmacodynamic variability.[38] Also, this method is not useful for evaluating adherence to medications with short half-lives.[42] Third, a single blood sample can be misleading as it only provides a snapshot of medication use and does not provide insight into use over time. As Cramer et al. observed[59], patients may increase their adherence rate for the few days before and after an appointment, thus artificially raising blood levels to the 'therapeutic' range.[55] Multiple sample times and unscheduled visits may improve the accuracy of this method[41,56], however these initiatives significantly increase workload and complexity.[58] Finally, the patient must be present for collection of the sample. This creates logistic complications to schedule patient appointments at correct times and can greatly increase monitoring costs.[58,60] These factors can make direct measurement methods impractical for larger population-based studies.[61]

2.3.2 Indirect Methods

Indirect methods of measuring adherence rates are relatively easier to use and are more commonly reported in the literature. Examples of these methods include the clinical outcome of therapy, clinician impression, patient report, pill counts, electronic monitoring devices, and prescription refill records.[41,56] Each of these methods has inherent advantages and disadvantages.

2.3.2.1 Therapeutic Outcome

Basing the estimation of adherence on whether or not the patient reaches a therapeutic outcome may seem to be a simple assessment. Successful treatment as evidenced by resolution of an infection, reduction of blood pressure or serum lipid levels, or prevention of seizures would theoretically indicate good adherence. However, this is not a specific measure because the patient may improve despite poor adherence or have good adherence to an ineffective therapy. It is estimated that 23-50% of hypertensive patients who have reached normal blood pressures are not adherent to therapy.[62] The 'placebo effect' seen in clinical trials illustrates how a patient can improve clinically despite the absence of active therapy.[63,64] Furthermore, external factors such as occupational exposures, socioeconomic status, genetic predisposition, dose of medication, disease variability, and other therapies (e.g., lifestyle modifications) can alter the therapeutic outcome irrespective of the adherence rate. The relationship between therapeutic outcome and adherence rate cannot be viewed as a direct causal relationship because of these many covariates. Therefore this method has limited usefulness.[41]

2.3.2.2 Clinician Impression

Clinician impression is an imprecise method for estimating adherence rates. Studies have consistently shown that clinicians are unable to accurately predict adherence rates. In one of the first studies examining this method, a group of 27 ward residents could not predict adherence to antacid therapy any better than if they had picked a rate at random. In addition, the majority of physicians overestimated adherence rates.[65] In a second study, house staff physicians were asked to discriminate between patients who would be adherent and non-adherent upon discharge from a medical ward. Less than half

of the patients reporting poor adherence (defined as taking less than 90% of their medications) were correctly identified by the physicians.[66] The length of relationship and familiarity with the patient does not seem to improve this estimate. Despite following 58 of 74 patients for over five years, a group of 10 family physicians were no better than chance alone at predicting adherence.[67] Due to these inaccuracies, clinician impression is not recommended for assessment of treatment.[41]

2.3.2.3 Patient Report

Asking patients about their adherence is a simple and practical method for discriminating between adherent and non-adherent patients. Nonjudgmental questions are typically used to determine if a patient has trouble taking medications.[68] It is well recognised that the accuracy of this method is limited by the truthfulness of the patient's report.[41,69-71] Patients may misrepresent their adherence rate, often overestimating their actual rate because they may be embarrassed, forgetful, or afraid.[69] Furthermore, patients will sometimes tell caregivers what they think the caregiver wants to hear.[42] Accuracy of the patient report may improve when the patient is interviewed in a non-threatening environment.[58,72]

Several authors advocate asking the patient about medication use because this method accurately detects non-adherence when the patient reports poor adherence.[14,58] Interviews may also provide insight into the reasons for poor adherence which would not be achieved through the use of other methods.[58] When a group of hypertensive patients were asked a general, non-threatening question about the difficulties of taking medications, 90% of those reporting poor adherence were considered non-adherent by pill count.[73] A recent study comparing patient-reported adherence to pharmacy refill

records and electronic monitoring devices found similar results in which non-adherence was accurately reported.[71]

Patient-reported adherence can be influenced by the way a clinician poses the question(s).[41,68,72] Non-threatening environments such as the patient's home or a familiar setting may provide an external advantage that improves the accuracy of patient-reports.[72] It is well established that the patient's relationship with healthcare professionals is a strong influence on communication and adherence.[33] Through the use of non-judgmental questions, clinicians can lessen the influence of this barrier to reliable responses.[72,73] Morisky et al. suggested that the inclusion of information gained from patient interviews represents a significant improvement in the assessment of adherence rates.[74] Building on an approach developed by Green et al.[75] and based on the theory that medication errors of omission occur because the patient forgets, is careless, stops when feeling better, or stops when feeling worse, four questions were created.[74] One question is used to address each of the four components in order to produce a clearer picture of the patient's adherence rate. This scale provides a feasible and reliable method for assessing adherence in patients requiring long-term therapies.[74]

The addition of patient-reports to other assessments of adherence may improve clinical assessment of medication effectiveness and patient management. When interview data is combined with objective assessments such as refill frequency, the accuracy of predicting poor adherence increases significantly.[76] Clinical assessment and responses to simple adherence-related questions can identify patients who have reached therapeutic targets despite low adherence rates.[68] This provides a more accurate evaluation of therapy, which can lead to appropriate adjustments in medication

regimens.[62] Clinicians should include questions related to medication adherence in their routine patient assessment.[41]

2.3.2.4 Pill Count

Counting the residual number of pills is a common method of adherence assessment in clinical trials.[14] During visits with the patient, the contents of each prescription vial are counted and compared to the amount that should be present accounting for perfect adherence. Although this method is considered one of the more accurate indirect measurements, it cannot verify the timing of doses or that the medication was actually taken.[55,71] The advent of blister packaging and weekly medication dispensers has greatly increased the patient's ability to monitor their own adherence rate. Tablets remaining in one or more compartments indicate to the patient that a dose was missed.

Unfortunately, repeated use of this method can sensitise the patient and thus alter the accuracy of pill counts.[55] To convey an appearance of good compliance, the patient may remove some of the pills prior to a visit, leading to 'parking lot' or 'toilet bowl' adherence. It is also difficult to ensure that all pills are brought in during the clinic visit.[58] Surprise visits and spot checks can increase accuracy of pill counting, however as with directly measuring fluid samples, this significantly increases the workload and complexity of adherence assessment.[55,73]

2.3.2.5 Medication Event Monitoring Devices

Electronic monitoring devices were introduced in the 1970s to record use of prescription eye drops.[77,78] Conventional versions of these devices contain a sensor and microprocessor in the lid to record each time a prescription vial is opened.[79] The time

and date can be reviewed to verify patient reports and provide greater insight into patterns of medication use. Although the device does not verify consumption, supporters of this technology suggest that opening the vial without consuming the medication is unlikely. These devices are used clinically to prove poor adherence as well as determine whether adverse events occurred after missed doses or excessive use.[42]

Electronic monitors are considered very reliable indirect measures of medication adherence because of their close link between the recorded event and medication use behaviour.[71] Other indirect measures are considered less reliable because of the distance between the measure and actual behaviour. For example, pill counts often overestimate adherence rate because pill dumping and failure to return unused medications can confound this method.[71,79] Furthermore, the 'real time' data generated from electronic monitors make these devices more sensitive to fluctuations in medication consumption and in fact provide a better picture of the patient's medication use behaviour.[80] Consumption of extra pills (over adherence), erratic dose intervals, and oscillation between non-adherence and over adherence are less likely to be detected by pill counts or refill frequencies because they provide an estimate of average rate consumption over the measurement interval.[71,79,80]

The sophistication of these devices has grown significantly over the past few years, leading to great reductions in size and improvements in recorded information.[71,77] However, the costs of these electronic monitors limit their widespread use in practice or large clinical trials. Furthermore, the ability to record consumption is lost when patients transfer medications to another container, since many patients prefer to carry a smaller medication container for daily use and for midday dosage times.[32]

2.3.2.6 Prescription Refill Records

Prescription refill records are considered to be useful when direct measurements are not feasible, such as in studies with large populations.[61] The most common measure is calculated as the total daily supply of medication obtained over multiple intervals, divided by the total number of days in the entire time period.[61] The use of short study time periods can lead to distortions in the calculated adherence rate because patients may obtain refills before the previous supply is completed.[81] The ideal time period is not certain, however it is generally recommended the study period should be greater than 60 days and encompass two or more refills.[61,81] When compared to other methods of medication adherence, refill records demonstrated good correlation[61,70,71], which supports their validity.

Reviewing the refill history has several advantages over other indirect methods because it is not subject to biases such as the Hawthorne effect (improvement due to observation) and the halo effect (patients provide desired responses).[70,82] Although a refill history does not ensure the medications are used exactly as prescribed, this method reliably confirms that the patient is exposed to drug therapy and also identifies gaps in treatment.[61,83]

The use of pharmacy records to measure adherence is limited by the completeness of the database.[38] Accuracy of this method is confounded when the patient uses physician samples during the study period or collects a large supply either prior to an extended trip (e.g., Canadian "snowbirds" travelling south for the winter) or prior to deadlines for deductible limits. Accuracy can also be confounded when the patient obtains a supply of medication from outside of the pharmacy system (e.g., Health

Maintenance Organization or Veterans Affairs Medical Centre) that was used to measure refill frequencies.[61] In Canada, provincial prescription claims databases can be used to obtain refill frequency data, thus reducing the chance of missed information.[70] However, these databases may be limited by the scope of eligible populations (e.g., only those 65 years and older).

2.3.3 Summary of Methods to Measure Adherence Rate

In summary, the ideal method for assessment of adherence is yet to be discovered. The success of an intervention program will be enhanced when those who are at highest risk for treatment failure due to poor adherence are identified (Figure 2.1). Although all existing methods fall short in their ability to accurately measure the adherence rate, some do provide a reliable mechanism to discriminate between those with good adherence and those with poor adherence.[80] The missing link in all adherence measurements is the ability to record actual medication use at the time of consumption.[80] Despite these deficiencies, each method has its own strengths. Researchers should be aware of the strengths and weaknesses of each method as well as the intended use of the data when choosing a measure.[70] Many researchers advocate the use of patient self-report because of its qualitative information, which is useful in determining reasons for poor adherence.[55,68,71] Combination of two or more methods can improve the accuracy of discrimination between those with good and poor adherence and is generally recommended for research purposes.[56,76]

Figure 2.1 Risk Categories for Treatment Response and Adherence

		Adherent to Therapy? Yes	Adherent to Therapy? No
Therapeutic Response?	Yes		
	No		Highest Risk for Treatment Failure

For assessment of adherence rates in large study groups, use of pharmacy refill records are recommended.[61,70,82,83] Addition of patient self-report may improve accuracy of this measure.[55,68,71] To predict poor adherence in a clinical setting, Haynes provided a set of three steps: 1) watch for those who miss appointments; 2) watch for those who do not respond to therapy; and 3) ask patients who are not responding to therapy if they are taking their medications.[84]

2.4.0 Prevalence of Non-Adherence

One issue that all adherence literature agrees upon is that the proportion of patients who are optimally adherent is well below 100%.[38,47] The actual rate of non-adherence varies by disease state, setting, duration of therapy, method used to measure adherence, and definition of non-adherence. In a recent review of the adherence literature, Nichol et al. found the overall quality of studies to be poor, which makes interpretation of the results difficult.[56] However, it is generally accepted that the rate of non-adherence to long-term therapies averages about 50%.[14,46,85,86] After reviewing the contemporary literature on adherence in hypertension, Eraker et al. suggested that 50% of patients will stop therapy after one year and only two-thirds of the remaining patients would consume sufficient medication to adequately control their blood pressure.[14] For

example, if 100 patients started therapy, only 30 would continue with adequate adherence to control their blood pressure after one year.

Certain generalisations can be made about the epidemiological characteristics of non-adherence.[47,87] First, non-adherence is more common in therapies for disease prevention than for treatment of established illness. Second, a patient is more likely to be non-adherent to therapies that require significant lifestyle changes (e.g., smoking, weight loss). Third, patients with asymptomatic diseases (e.g., hypertension, hypercholesterolemia) are less likely to adhere to therapy than those with symptomatic diseases (e.g., epilepsy, chronic pain, diabetes, asthma). Finally, the changing epidemiological characteristics of chronic disease will have great implications on adherence in both clinical care of the patient and research.

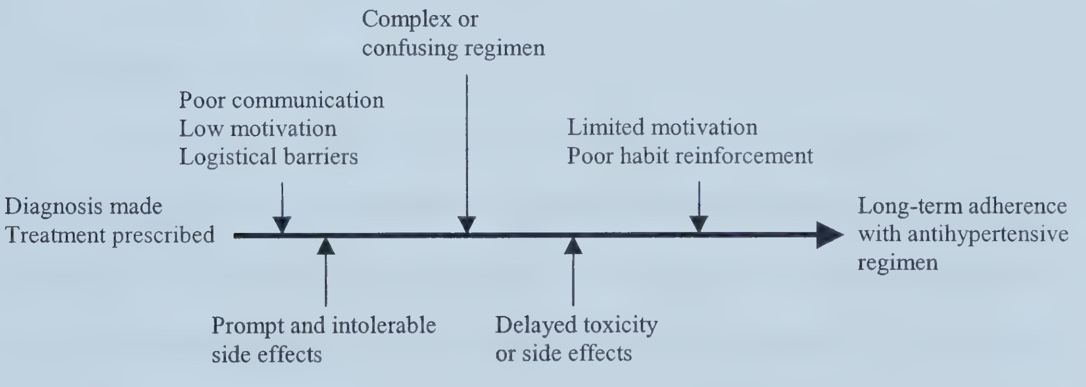
Adherence research has involved many chronic diseases, especially hypertension, epilepsy, diabetes, asthma and congestive heart failure. Each chronic disease has unique features that contribute to the overall understanding of adherence.

2.4.1 Adherence in Hypertension

Adherence studies have predominantly focussed on hypertension, resulting in several comprehensive reviews of this literature.[49,53,86,88] The prevalence and treatment of hypertension in Canada can still be explained using the rule of halves developed by Bannan et al.[89]: half of all hypertensives are known, half of the known hypertensives are treated, and only half of these reach a normal blood pressure.[90] Patients diagnosed with hypertension face barriers to full adherence, which can appear at various times during treatment.[88] These barriers are not limited to hypertension and can appear in other

chronic diseases (Figure 2.2).[88] As with other asymptomatic diseases, patients will stop taking medications because they believe the medication is ineffective or because of intolerable adverse effects.[49] It is generally agreed that the average adherence rate in hypertension is 50%, yet estimates range from 20% to 80%.[53] Variability in these estimates may be due to the patient group studied, method for estimating the adherence rate, definition of adherence, setting of the study (clinic or community), duration, and therapeutic regimen used.[53] The importance of adherence in the success of hypertension treatment is illustrated by the recognition that strategies to improve adherence are considered necessary treatment issues in the latest American guidelines for treatment of hypertension.[91]

Figure 2.2 Barriers to Adherence in Antihypertensive Therapy



2.4.2 Adherence in Epilepsy

Epilepsy is another condition in which adherence has received particular attention. All patients with epilepsy will have suffered two or more seizures.[92] With these experiences, patients know that a seizure can be frightening to witnesses and

potentially dangerous for themselves. They also understand the implications of poor seizure control such as loss of work and driving privileges. Through education and continuous reinforcement, patients are aware that prevention of seizures requires long-term therapy with effective medications. Despite this level of understanding in their condition and knowing the benefits of continued medication use, it is estimated that 30% to 40% of patients with uncontrolled seizures are non-adherent to their medications.[93,94] Several reasons for this relatively high rate of non-adherence have been suggested including forgetfulness, lack of understanding the importance of regular dosing, confusing medical advice, adverse effects, complexity of the regimen, and perceived lack of effectiveness.[95] Furthermore, when a patient is seizure-free for a long period of time, they can become complacent and reduce their rate of medication adherence to 'test' where the minimal dose is to maintain seizure control.[96]

2.4.3 Adherence in Diabetes

The definition of adherence to diabetes regimens takes on various forms, depending on the perspective and interests of the investigator. Adherence has been defined in terms of ability to perform certain self-care tasks, use of recommended dietary and exercise plans, degree of glycemic control, and use of medications.[97] Three concepts are important for the understanding of adherence in diabetes. First, there are multiple dimensions to diabetes self-care including diet and exercise activities, glucose monitoring, administration of medications, preventive activities (carrying an emergency supply of glucose and checking for foot ulcers).[98] Adherence to one of these dimensions does not necessarily correlate with adherence to other dimensions.[98,99] Second, patients

are often given dosage ranges in which to make self-adjustments. As the focus of treatment shifts to tight control of serum glucose levels for prevention of long-term complications, patient control over dosages and administration times increases.[100,101] This move, however, results in the absence of a specific 'prescription' to use in the calculation of an adherence rate.[102] Third, diabetes has a spectrum of pathologies and complications, resulting in a heterogeneous mix of patient groups.

Given the complexity of adherence in diabetes, it is important to define the patient group and treatment area of interest when reporting the findings of a study.[97] It is not surprizing that estimates of non-adherence rates in diabetes range from 23% to 93%.[103] Taking these factors into account, two general statements can be made about adherence in diabetes. First, adherence is better to the medical aspects of diabetes management compared to lifestyle aspects.[99,104] Second, blood glucose monitors provide the most objective measurement of adherence to diabetes regimens.[97] Studies using monitors that have memory to record the date and time of blood glucose assessments illustrate the lack of (or "low") reliability of patient self-report and need for objective measures to evaluate adherence.[97] For example, when they were unaware that glucose monitors could record the number of tests, over 50% of the patients reported inaccurate frequencies of tests.[105]

2.4.4 Adherence in Asthma

Asthma is defined as a chronic inflammatory process in the lungs that causes symptoms of airway obstruction in susceptible individuals.[106] Symptoms of airway obstruction can be relieved with the use of beta-adrenergic agonisits such as salbutamol whilst the underlying inflammatory process is treated with corticosteroids.[106] In

hypertension, epilepsy, diabetes and other diseases, medications are taken primarily to prevent the onset of symptoms, whereas in asthma, bronchodilators are used to treat acute symptoms. The beneficial effects of bronchodilators are experienced immediately by the patient suffering from acute symptoms of airway constriction. Corticosteroids used to treat the underlying inflammatory process would face the same challenges to good adherence as those in other chronic diseases.

Adherence assessments in asthma have several unique features. First, the coordinated effort of inspiration, positioning of the inhaler and its activation make it technically difficult for the patient to administer the medication effectively. Although several spacer devices and holding chambers have been developed, the complex nature of this dosage form makes it impossible to associate activation of the device with proper administration of the medication.[107] Second, the Nebulizer Chronolog was developed to record activation of a metered dose inhaler and used in the majority of adherence studies in asthma. The size of the device made it difficult to hide the fact that patient adherence was being measured and therefore could influence the study results.[107] Third, under use of medications compared to the prescribed dose is common in asthma as in other diseases; however, overuse is also a major issue. Patients who overuse their medications in symptomatic diseases such as asthma may be experiencing progression of their disease and may be at increased risk of death.[108] For this reason, detection of overuse may be more important than detection of under use.[107] In view of these challenges, estimates of adherence range from 46% to 196%.[109] However, given the impact of patient awareness in these adherence studies, these may be overestimates of the actual rate of adherence in asthma.[107]

2.4.5 Adherence in Congestive Heart Failure

Congestive heart failure is a syndrome characterized by a chronic progression of factors that limit the heart's ability to meet the body's demands.[4,8] Management of this disease process encompasses both symptom control with diuretics and digoxin as well as prevention of disease progression with angiotensin converting enzyme inhibitors, beta-blockers and spironolactone.[4]

Studies of adherence to both treatment approaches have demonstrated that adherence to long-term therapies may be less than optimal and that patients often tailor their use of diuretics. One study evaluating the use of digoxin in congestive heart failure reported that the average patient was without digoxin for one third of the year.[20] Furthermore, only 10% of the study group had a sufficient supply of medication for the entire year. When asked about their use of these agents, patients report departures from the prescribed dose based on the effects these agents have on their daily plans.[31,32] This practice is consistent with the theory of intelligent non-compliance, whereby patients make reasoned decisions about how they will use medications.[110,111]

The changing epidemiological picture of chronic disease is increasing the pressure on adherence research and interventions in clinical practice.[47] As more people survive acute events and live longer with other chronic diseases such as hypertension and diabetes, the prevalence of severe disease will increase. For example, advancements in the management of cardiovascular disease have dramatically reduced morbidity and mortality; at the same time this has increased the number of patients surviving to ultimately develop congestive heart failure.[13] Several groups have recognized the

growing importance of adherence and have incorporated recommendations into their guidelines and policy statements.[1,34,91,112]

2.5.0 Effect of Poor Adherence

There is general agreement in the literature that poor adherence to proven efficacious therapy results in harm to both the patient and the healthcare system. German et al. summarized the impact of poor adherence into: 1) disruption of the course of treatment; 2) unnecessary diagnostic and treatment procedures; 3) questions by patients about treatment efficacy; 4) confounding of evaluation of treatment effectiveness; and 5) confounding of clinical trial assessment of specific therapies.[47] The effect on both the patient's health and society's resources has been the subject of much research.

2.5.1 Clinical Effects

Patients who choose to take a suboptimal amount of medication increase their risk of symptom exacerbation, hospitalization, and even death.[16] Patients at risk for coronary artery disease have several treatments available to help reduce their risk. However, when patients are not adherent to therapy, the beneficial effect of cholesterol-lowering agents, angiotensin converting enzyme inhibitors, and beta-blockers is reduced significantly.[16] Interestingly, some studies have illustrated that adherence to placebo is associated with a reduction in the risk of morbidity and mortality.[17-19] This suggests that poor adherence could also be a marker of prognosis and/or other poor health related behaviours. The consequence of poor adherence to antihypertensive therapy is illustrated in a study by Psaty et al.[113] Using an adherence rate of 80% to dichotomize a cohort of hypertensive

patients, those who had poor adherence were four times as likely to develop coronary artery disease. These studies and numerous others consistently show that the beneficial effect of proven efficacious therapies is jeopardised when patients are non-adherent.

2.5.2 Economic Effects

The economic burden of non-adherence in Canada is estimated to be between \$7 and \$9 billion.[45] This estimate is consistent with an estimate in the United States that non-adherence was associated with over \$100 billion US in unnecessary health care costs.[114] However, estimates of the impact of non-adherence on society are imprecise because there are few studies examining the aggregate cost of non-adherence.[45,115] True estimates are hampered by the complex nature of non-adherent behaviour and the dynamic relationship between disease and medical therapy. Coambs et al. used a cost-of-illness model[116] to derive their estimate of the financial burden of non-adherence in Canada.[45] In this model, non-adherence was viewed as a disease because of its many characteristics that are similar to a disease.[114] For example, 1) there are certain risk factors associated with severity, 2) there is a need for clinicians to identify those patients at greatest risk of non-adherent behaviour, and 3) some patients with non-adherence can be 'cured'.

Direct costs of poor adherence include hospital and institutional expenditures, additional treatment costs, and costs associated with treating poor adherence. The costs of excessive hospitalizations and emergency room visits have been reviewed extensively elsewhere.[117] It is estimated between 2.1% and 12.8% of all hospitalizations were due to poor adherence to therapy.[117] Coambs et al. used a conservative rate of 6.5% to estimate

that \$1.78 to \$2.74 billion in hospital expenditures during 1993 were due to non-adherence.[45] Considering that 15% to 64% of the hospital admissions for congestive heart failure are due to non-adherence, this represents a major health care burden in Canada.[21-24]

2.5.3 Specific Issues in Congestive Heart Failure

Several investigators have explored the causes of treatment failure in CHF leading to hospitalization and death. Many factors can trigger an exacerbation of congestive heart failure including alcohol consumption, smoking, psychological stress, uncontrolled hypertension, cardiac arrhythmia, myocardial ischemia, and poor treatment adherence.[25] Of these factors, poor adherence to the medical regimen is considered the most common preventable factor leading to treatment failure.[26] Depending on the population studied, poor adherence to diet and/or drug therapy was associated with hospital admission for CHF symptom exacerbation in 15% to 64% of the cases.[21-24] It is therefore not surprising that clinicians recognise the increased importance of adherence and include recommendations to improve adherence in their guidelines for the management of congestive heart failure.[3,34,118] Furthermore, numerous investigators have demonstrated the benefits of multidisciplinary teams to improve the outcomes of heart failure management, especially when they implement measures to improve adherence.[119-123]

2.6.0 Predictors of Adherence Rate

Numerous studies have examined the predictors of adherence. Over 200 variables have been studied to determine their association with adherence.[15,124,125] These variables

can be generalized into five categories (Table 2.2): 1) characteristics of the patient, 2) characteristics of the treatment regimen, 3) features of the disease, 4) the relationship between the health care provider and the patient, and 5) the clinical setting.[15,125] Over the past 25 years, researchers have examined these factors in the hope that a method of identifying patients at risk of poor adherence could be developed. This process continues to be an important focus of adherence research today.[34] Despite the numerous studies, very few factors are consistently correlated with poor adherence.[37,38,40] Statistical significance of the association between factors and adherence varies among studies as well as diseases.[38,124]

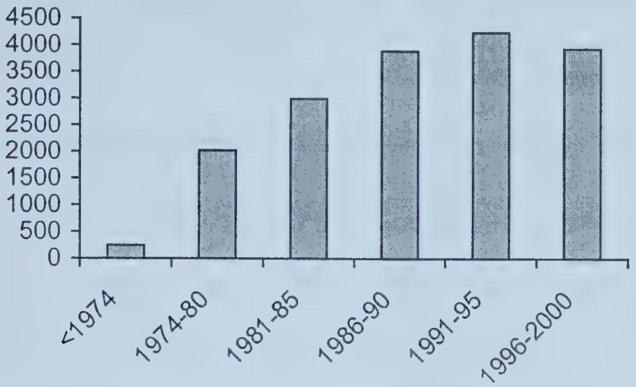
Uncertainty in the literature over the factors associated with poor adherence may be understood by examining the concept used to explain this behaviour.[37,40] The growth of research interest in adherence is illustrated by the dramatic rise in articles published on this topic (Figure 2.3). The majority of this research has been conducted by healthcare professionals and based on an ideology of compliance rather than adherence.[40] As stated earlier, the concept of compliance is an extension of the paternalistic model of health care in which the authority of decision-making rests solely on the healthcare professional.[40] Any deviation from the healthcare professional's advice (i.e. noncompliance) is considered a failure by the patient.[37] With this limited view on adherence, it is not surprising that research into the determinants of poor adherence has been inconclusive. By defining patient behaviour in terms of another's expectations, researchers have ignored the important role of patient autonomy.[37]

Table 2.2 Factors Used to Predict Poor Adherence

Patient Characteristics	Age Gender Level of education Socioeconomic status Marital status Social support network Race Sensory disabilities Forgetfulness Lack of understanding Apathy and pessimism Ability to detect illness or need of medication Participation in treatment decisions
Characteristics of the Treatment Regimen	Type of medication Route of administration Duration of therapy Degree of behavioural change Complexity (number of medications and dose frequency) Dosage Cost Adverse Effects Health Insurance Container design (safety locks)
Features of the Disease	Confidence in diagnosis Severity Symptoms Degree of disability Exacerbation of symptoms Hospitalization Length of stay in hospital Clinical improvement Social acceptability of disease
Relationship with the Healthcare Provider	Confidence in clinician Ease of communication Continuity of care Intensity of follow-up
Clinical Setting	Convenience of location Waiting time Referral to a specific clinician vs. to a clinic Elapsed time between referral and clinic visit Clinic operation (efficiency, unfriendly personnel)

Adapted from references 15,43,124,125

Figure 2.3 Articles on Adherence by Year of Publication



Adapted from references 37,126

For many years, researchers have assumed that the patient plays a passive role in treatment decisions. Research originating from social science has explored the active role patients take in non-adherence. This perspective acknowledges that patients make reasoned decisions about their use of medications and that these decisions may conflict with medical advice.[39,40,110,127] Patients often conduct "mini experiments", by reducing the dose prescribed or skipping doses, usually to avoid adverse effects or to determine the need for medications.[110] Through the practice of intelligent non-compliance, patients may discover the lowest level of effective medication for themselves and therefore make appropriate adjustments to their treatment regimen.[40,62,110] In essence (and contrary to previous beliefs), patients do not fail to comply, they choose to take an alternative action.[40] Instructions from the healthcare provider are considered in view of other factors when making decisions about medication use.[40,110]

The evolving role of the patient in medical decision making requires a change in the approach to adherence research.[37] Patient opinions regarding medication use have been critically absent from previous research.[39,40,127] A greater understanding of the

patient's ideas, values and attitudes towards medication use will enhance the clinician's ability to improve adherence.[39127]

2.7.0 Behavioural Models in Adherence Research

Behavioural models provide theoretical frameworks to help clinicians understand patient views on medication use.[128] Four major theories of health behaviour have been used to guide adherence studies: 1) biomedical model; 2) operant behaviour and social learning; 3) communication; and 4) rational decision models. Although these theories use similar factors (recognition of illness, perceived risk, motivation, use of coping behaviours, and evaluation processes), the focus and constructs within each model differ.[45,128]

2.7.1 Biomedical Model

Early researchers approached the problem of poor adherence as they would any other disease by assuming it resulted from some biomedical dysfunction.[128] Using this framework, poor adherence was considered to be the result of a personality aberration or trait of the patient. Studies focussed on the search for correlation between adherence behaviour and demographic characteristics, such as age, gender, marital status, education, and socioeconomic status. Studies utilizing the biomedical perspective have identified some useful technological advances to help improve adherence, such as packaging multiple medications into single dosage forms and development of controlled release medications.[128] Although numerous patient characteristics and socioeconomic factors have been identified, few are reliable enough to be clinically useful.[124,128] This may be

due to the fact that the biomedical model ignores the psychological processes of the patient when they are faced with an illness.[128] These early studies led to the realisation that poor adherence is the result of complex processes and not simply the presence of certain characteristics.

2.7.2 Incorporation of Psychological Aspects

Adherence research evolved to include an examination of behaviours needed for adherence by adopting learning theories.[128,129] Behavioural models focus on the stimuli or cues that result in adherent behaviour, the rewards of good adherence, and the evolution of adherent behaviour into a habit. The constructs of behavioural theories have been used primarily in studies to change harmful lifestyles such as smoking and obesity.[129,130] The major deficit of behavioural theories is their inability to demonstrate long term changes in behaviour as evidenced by the high rate of relapse once the study is completed.[128] By focussing on the reinforcement of desired behaviours, studies miss social and motivational forces involved in adherence. Furthermore, concentration on behaviour and its stimuli will not account for the cognitive processes patients go through when deciding on a specific course of action.

A communications approach to adherence research assumes the patient is uninformed and seeks the expert advice of a healthcare professional. There are six steps in this process: 1) generation of the message, 2) reception by the target audience, 3) comprehension, 4) retention, 5) acceptance, and 6) action.[128] Studies using this approach have shown that the timing of delivery and clarity of the message affect the reception, comprehension, and retention of the message.[33,131] Other factors that are external to the

message influence the acceptance and incorporation into action. For example, patients' satisfaction with the relationship that they have with the source of information has a strong positive correlation with adherence.[33,132] It is also important to include action plans to help the patient incorporate the new activity into their daily routine and promote the formation of an adherence habit.[128] The communication model falls short, however, in explaining the mechanisms that determine acceptance of the health message and its incorporation into adherence activities.[128]

2.7.3 Incorporation of Decision Making Attributes

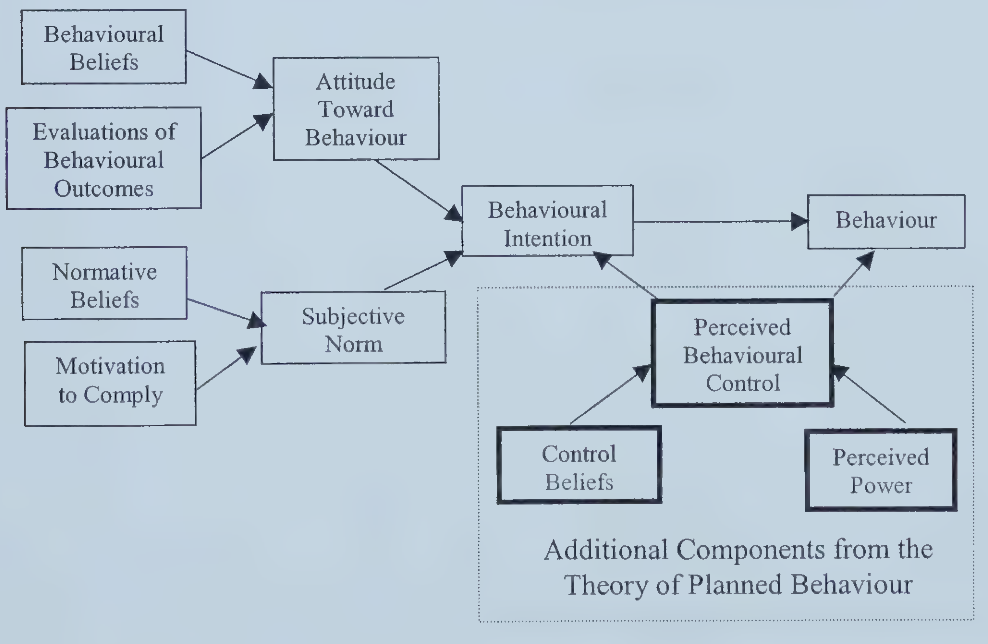
Rational belief theories assume that health behaviours are determined through the individual's ability to process appropriate information and make an informed decision.[128] The core of these theories rests on the patient's conscious or unconscious weighting of the benefits and risks associated with a given health activity.[29,133] Poor adherence results from either a lack of information on the benefits and/or hazards associated with a given health activity or from the patient's decision that the risks or inconvenience outweigh the benefits. The framework provided by these models help to examine the patient's perception of risk, elements of the thought process, individual characteristics to predict adherence, and motivating factors.

2.7.3.1 Theory of Reasoned Action and Theory of Planned Behaviour

The Theory of Reasoned Action and its extension, the Theory of Planned Behaviour, suggest health-related behaviours are motivated by the individual's attitude towards performing the behaviour and his/her perception of the societal norm.[133,134] These theories assume a causal chain beginning with the individual's beliefs and

perceptions that produce a behavioural intention, resulting in an observed behaviour.[135] The Theory of Planned Behaviour adds a construct to the Theory of Reasoned Action, which assumes the individual does not have complete voluntary control over behaviour (Figure 2.4). The Theory of Reasoned Action has been used to examine many health-related behaviours including smoking, drinking, clinical breast exam and mammography use, and flu vaccine use.[135] In terms of medication use, patients will adhere to therapy if they believe the medication will improve their health (positive attitude) and/or expectations from the patient's social network provide sufficient motivation (subjective norms)[45,135] However, these theories provide an incomplete picture of the factors that motivate action. There is more to motivation than perceived social norms and patient beliefs about their behaviour.[128]

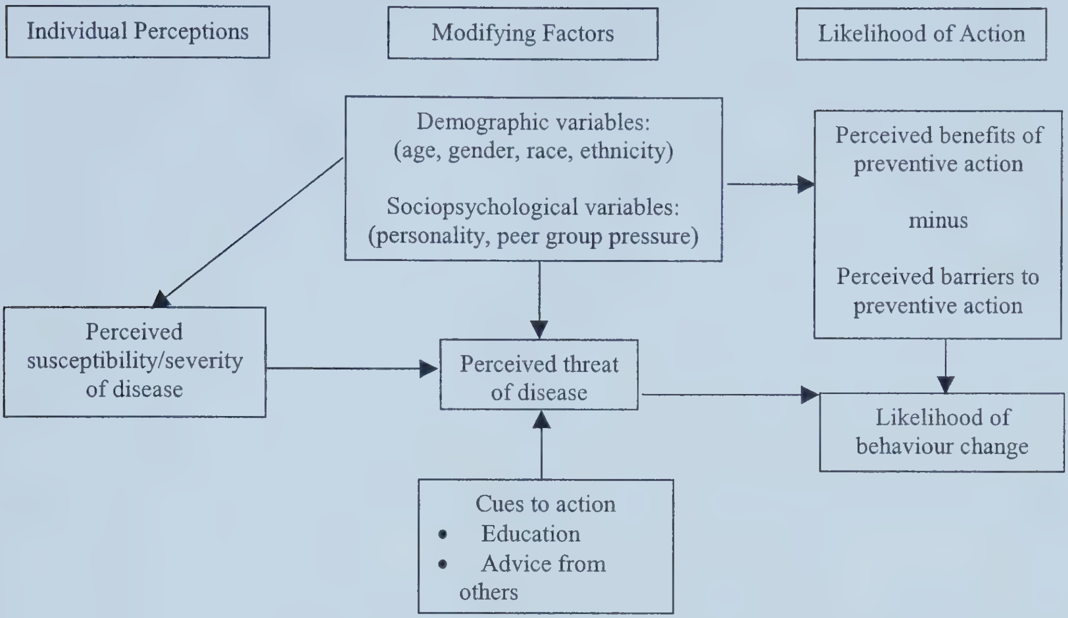
Figure 2.4 Theory of Reasoned Action and Theory of Planned Behaviour



2.7.3.2 Health Belief Model

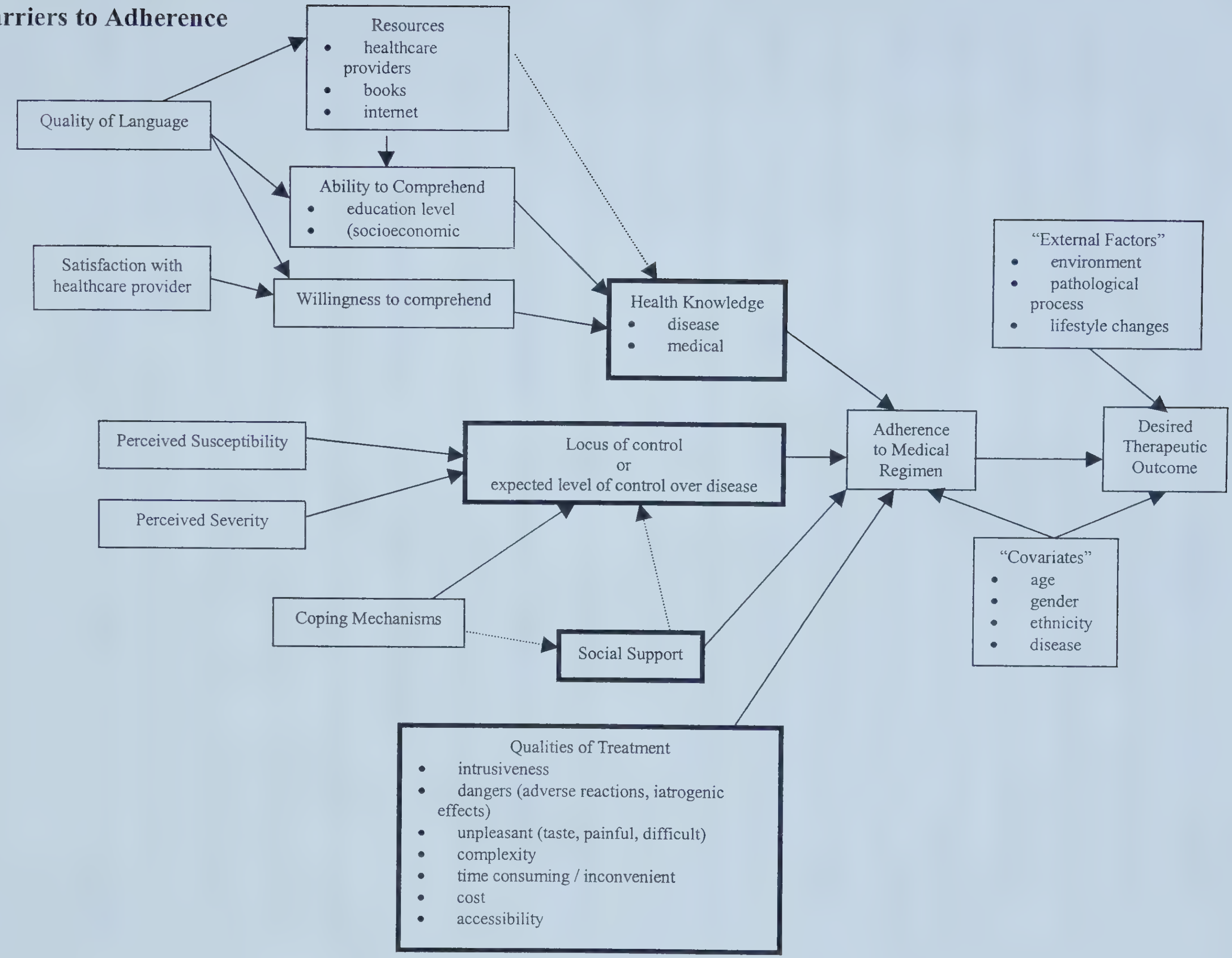
The Health Belief Model (HBM) is one of the most widely used conceptual frameworks for health behaviour and adherence research.[29,128]. The HBM evolved from the *value expectancy* theory in that: 1) patients desire to avoid illness or to get well (*value*) and 2) they believe that a specific health action available to a person would prevent (or ameliorate) the illness (*expectancy*).[30] Becker extended the HBM to apply to patients' actions with respect to their use of medications.[28] This model has four key concepts to describe the thought process behind medication use (Figure 2.5).[29] A patient will adhere to therapy if they believe: 1) they are susceptible to an illness, 2) there is potential for serious consequences, 3) an available course of action (for example taking medications) would reduce either their susceptibility or severity, and 4) the perceived benefits of a course of action outweigh the barriers. Through their assessment of susceptibility and severity of consequences, the patient develops a motivation for action.[128] The patient then weighs the perceived effectiveness of the action against potential negative outcomes in a pseudo cost-benefit analysis.[29,128]

Figure 2.5 Health Belief Model



Of the four constructs in the HBM, **the perception of barriers appears to be the most powerful predictor of behaviour change**.[29,30,128] Following this model, a patient who perceives barriers to medication use will not fully adhere to medical therapy. Several authors have identified barriers to medication use through the theoretical framework of the HBM.[60,87,136-138] These barriers can be loosely categorized into health knowledge, perceived control over disease, social circumstances, and qualities of the treatment (Figure 2.6). The patient considers each of these factors when he or she is deciding whether or not to adhere to medical therapy.

Figure 2.6 Barriers to Adherence



2.8.0 Barriers to Medication Use

Within each barrier category, there are specific factors to consider. Health knowledge is influenced in part by the communication process, which relies on the patient's satisfaction with the healthcare professional.[33,131] The patients' perceived level of control over their disease could be influenced by their perceived vulnerability, the strength of their social support network, and their coping strategies.[87,137,138] Patients find social support in their family and friends as well as others with the same disease.[32,87137] The quality of the relationship is more important for adherence than the quantity of support.[87] Lastly, there are numerous qualities of the medical regimen that can create barriers, including the degree of intrusion into the patients' lifestyle, adverse effects, and complexity of the regimen.[87,137,138]

A *barrier to medication use* is present only when the patient perceives it to be so. Previous adherence research has used the perspective of the healthcare provider to determine factors that influence medication use.[37,40,127] The patient's perspective is a vital, yet poorly explored viewpoint for identifying barriers to medication use.[39,40,127] To better understand the reasoning behind behaviours such as adherence to medical therapy, the focus of research must shift to the patient.[40,127] The patient is best suited to identify the factors that can be potential barriers to medication use. By exploring the patient's views, opinions, and attitudes towards medication use, researchers can develop greater insight into this behaviour and therefore develop more effective interventions to improve adherence.

It is important to recognise that the presence or absence of these barriers is not the sole influence on a patient's adherence rate and clinical outcome. Several authors have

identified that certain demographic and socioeconomic factors can influence adherence as well as the disease process.[124] Factors external to the regimens studied, such as changes in the patient's environment, progression or remission of the underlying disease, changes to lifestyle, and other therapeutic interventions, can affect the clinical outcome.[41]

Clinicians need a simple and efficient method to identify patient-perceived barriers to medication use. One common method to evaluate patient behaviours and beliefs is to ask the patient to complete a short survey. Surveys can be administered by an interviewer or self-administered by the patient. One advantage of a self-administered instrument is that it can be completed in a timely fashion, such as while the patient is waiting in a clinic. Responses to the survey questions give the clinician patient-specific information in order to provide "real-time" interventions to improve healthcare. With the availability of numerous interventions to help improve adherence, clinicians must first identify the specific needs of the individual patient.[35,36] By meeting the needs of the individual, effectiveness of these interventions may be enhanced.[36]

2.9.0 Development of a New Instrument

The methodology for developing and testing a new instrument has been well established in the health related quality of life literature.[139,140] There are several specific steps that are followed.[139,140] The first steps are to clearly define the target population, the primary purpose of the new instrument, and describe how it will be administered.[140] Once these goals are explicitly stated, the next step is to generate items or questions for the instrument. There are several resources for developing relevant items, including discussions with healthcare professionals who work closely with the target patient

population, review of the disease-specific literature, review of similar questionnaires, unstructured interviews with patients, and focus groups.[140] Work done through literature searches and discussions with healthcare professionals can help prepare for the ultimate source of information, the patient groups.

2.9.1 Focus Groups for Item Generation

Focus group methodology is a very useful tool for generating relevant items for a survey because it can be used to examine complex areas of interest such as health behaviour.[141-143] Focus group techniques are well established in marketing research and are an accepted tool in qualitative health services research.[144,145] A focus group is a form of group interview creating a permissive environment that allows the participants to interact and share their opinions. As attitudes and perceptions are developed in part by interaction with others, the group environment gives the opportunity to divulge opinions that may not emerge in other forms of questioning. This qualitative research method has several advantages such as its speed of completion, high internal validity, and flexibility to explore unanticipated issues as they arise.[146,147] Other methods, such as mail and telephone surveys, rely on the participant's ability to understand and articulate exactly how they feel about an issue. In a focus group, participants hear other's opinions and beliefs, which may help them to articulate their own viewpoint. This "cueing phenomenon" may help the researcher extract a richer understanding of underlying issues and influences.[141,142] The information generated from focus group sessions can then be used to develop survey questions, format questionnaires, and generate new hypotheses.[140] Further, by audiotaping and analysis of the session transcripts, researchers can discover

the vocabulary participants use to describe their experiences, which may also be very useful in the wording of new survey instruments.[140,146]

2.9.2 Item Reduction

The next step in the development of a new instrument is to select those items that are most suitable for the final instrument. There are two generally accepted methods of item reduction: factor analysis and clinical importance.

2.9.2.1 Factor Analysis

Factor analysis involves a mathematical model to determine the inclusion and exclusion of items.[140] Items that are highly correlated with one another are grouped together and included in the instrument. Items that are not strongly correlated with the domains of interest are dropped. The main disadvantage of factor analysis is its reliance on statistical significance for inclusion of items.[143] For example, items that may be very important to patients could be dropped because they were not statistically influential in the model.[140] Furthermore, this process minimises the subtle interactions between two or more factors.

2.9.2.2 Clinical Importance

Judgement of the clinical importance of an item is an accepted alternative method for item reduction. Patients in the target group are asked to identify the issues that are frequent and important to them.[140] Focus group methodology is useful in this step as well. During the sessions, the amount of time spent and depth of discussion on each item provide an indication of its relative importance to the participants.[141] After interpreting the data, investigators can return to the participants to verify importance of the selected

items.[148] These processes of item reduction provide some confidence of the content validity of the new measure, by explicitly including the patients themselves in the development process.

2.9.3 Question Formatting

Once the items are selected for the instrument, the fourth step is to format each item into an answerable question. The main objective in this step is to create questions that will provide useful information. Fowler provides some guidance in this process: 1) make the questions self-explanatory, 2) restrict the questions to closed answers, 3) do not vary the response scale, 4) lay the questionnaire out in a 'user-friendly' format, 5) avoid skip patterns, and 6) repeat information to reduce confusion.[149] A guiding principle is that each question should apply to one concept.

2.9.3.1 Question Stem

The words used in the stem of a question are very important. They should be simple, clear, and specific. Ideally the words/terms used should be understood by and apply to all respondents. Double negatives and ambiguous wording should be avoided. Previous questionnaires may help guide the formation of new questions.[149] Focus group data are invaluable because the language and terms obtained from the transcripts can be used in the formation of questions.[141,142,144]

2.9.3.2 Response Options

Response options are categories or scales that the subject uses to respond to the questions.[140] Several scales are available, including: 1) dichotomous scales (yes/no), 2) semantic differentials (painful/painless), 3) Likert scale (ordinal scale with degrees of

agreement), and 4) visual analog scale.[143] Given the options available, the researcher must consider the audience (will the patients understand the scale) as well as the type of information required. For example, is it necessary to measure the extent to which a patient agrees with a statement, or simply collect a "yes/no" response?

2.9.3.3 Time Frame

A *frame of reference* is sometimes necessary to help patients remember their experiences and formulate a response.[140] A two week time frame is often preferred based on an assumption that this is the upper limit for a person to accurately recall events and emotions.[140] This timeframe can be modified at the investigator's discretion; within any one study however, consistency in recall period is suggested.

Once the questionnaire is formatted, it is useful to *pretest* it in a small group of patients. The purpose of the pretest is to ensure that the format, wording, and sequence of items will be understood by the target patient group.[140] This process will also help identify any unanticipated problems with survey administration and data processing prior to the actual testing procedure.[149] It is generally recommended to select at least five patients from the target patient population for this step.[139,140]

The final stage in instrument development is to test the measurement, or psychometric, properties. This testing process will ensure that the instrument is reliable and provides useful information for the clinician.

2.10.0 Psychometric Testing

2.10.1 Reliability

The purpose of reliability testing is to ensure that the relationship between signal to noise is maximised.[140] Testing will determine if the level of noise (both random and systematic errors) is too large for the instrument to detect the signal of interest. Two aspects of reliability are internal consistency of a set of questions and reproducibility of a score.

2.10.1.1 Internal Consistency

Internal consistency reliability refers to the correlation among items within the instrument. This form of reliability is usually assessed using Cronbach's α coefficient, which calculates the average of correlations among all items in a domain.[150] This coefficient is used to determine the degree of homogeneity, or in other words, the degree to which separate items relate to each other.[143] It is generally accepted that items in a scale should have a moderate degree of association with one another.[143] An α coefficient ranges from 0 to 1. A very high α value may suggest a high degree of redundancy, in which the same question is posed in slightly different ways.[151] For this reason, α should be above 0.70, but probably not higher than 0.90.[143,152]

2.10.1.2 Reproducibility

Reproducibility refers to the ability of the instrument to produce similar results when it is administered multiple times and assuming nothing has changed. The most common approach to evaluating this form of reliability is the test-retest in which the instrument is administered to the same patient at two or more occasions. The correlation

between scores is then calculated. The Pearson product-moment correlation coefficient (r) is commonly used to report the reproducibility of continuous data.[153] This measure describes the degree to which individuals who scored high on the first test will score high on repeated tests, and the degree to which individuals who scored low on the first test will score low on repeated tests.[154] However, one disadvantage of this measure is its inability to detect systematic differences between tests.[153] For example, if participants uniformly improved their score between tests one and two, the Pearson correlation coefficient for the test-retest would be 1. The two sets of scores would be highly correlated, yet systematically different.

The intraclass correlation coefficient (ICC) is a more appropriate method for measuring reproducibility.[153] This method evaluates the strength of correlation and detects departures from replication of results.[153] The ICC will decrease with either systematic or random differences between scores.[140] Values for the ICC range from –1 to +1, with 0 indicating a complete lack of agreement.

There is no acceptable interval between test administrations, and intervals have varied between one hour and one year.[143] A long interval may cause the underlying condition or confounding variables to change. During a short interval, the patient may remember their responses to the first survey. Generally, intervals of two to 14 days are considered sufficient.[143,153]

2.10.2 Validity

Assessment of the scale's validity is necessary to ensure that the instrument is actually measuring the intended traits. Validation testing is an ongoing process, whereby

evidence from previous studies is used to generate new hypotheses for future testing. Each supportive study strengthens the theoretical framework of the instrument.[143] There are four attributes of validity – face validity, content validity, criterion validity and construct validity. Untrained judges can assess *face validity.* Important factors to consider include readability, organisation, and overall presentation of the instrument.[143,155] *Content validation* is a subjective process, usually done by clinicians and others familiar with the topic of interest. The instrument is reviewed to ensure that all relevant and important elements of the topic are included.[143] Focus group methodology is a useful research tool because it provides a high level of content validity when used as an initial step in questionnaire development.[140,141]

2.10.2.1 Criterion Validity

Testing for criterion validity involves assessment of the correlation between a new instrument and a 'gold standard'.[143] A gold standard measure is an instrument that is well known, relevant to the topic of interest, and accepted as a good measure of the attributes of interest.[143] This form of validation is used to test a new instrument (e.g., a new scale for depression and the Beck Depression Inventory) or to test an abbreviated from of an existing instrument (e.g., SF-12 and the SF-36). There are two types of criterion validity: concurrent validity and predictive validity. With concurrent validity, the correlation between the new instrument and gold standard is measured when they are administered at the same time. With predictive validity, the new instrument is administered and compared to a criterion that is collected a some future time.[143] One problem with criterion validity is the need for an existing gold standard. In many

research areas, such as health-related quality of life and adherence, often no gold standard exists.

2.10.2.2 Construct Validity

In the absence of a gold standard and criterion validity, construct validation tests the strength of association between variables that are theoretically linked.[139,143] Constructs are underlying factors that influence a behaviour that can be observed.[143] Theoretical links between observed behaviours and the construct are used to generate hypotheses for testing. There are two types of construct validity: convergent validity and discriminant validity. Convergent validity refers to how close a new scale is related to other scales and variables that measure the same construct. Discriminant validity refers to the lack of association between variables that are considered to be dissimilar.[143] There is no single test or experiment to conclusively prove a construct.[143]

Chapter 3

Methods

3.1.0 Study Objectives

The purpose of this study was to develop and test a new instrument that would identify patient-perceived barriers to medication use in patients with congestive heart failure (CHF). Specific objectives were to:

1. Identify and explore patient-perceived barriers to medication use.
2. Develop an instrument to help clinicians identify patient-perceived barriers to medication use.
3. Evaluate the relationship between perceived presence of barriers and patients' use of medications.
4. Evaluate the psychometric properties of the new instrument.

3.2.0 Instrument Development

The following steps were taken to develop this new instrument: specify the measurement goals, generate items, item reduction, and questionnaire formatting.[139,140]

The measurement goals of the instrument were defined first. The purpose of this instrument was to assist clinicians in the identification of potential patient-perceived barriers to medication use. The instrument would evaluate patient, drug, and support network-specific areas that affect medication use. Therefore, an ideal instrument would have the ability to discriminate between patients who perceive certain barriers and those patients who do not. The instrument should also have the ability to evaluate the extent to

which certain barriers influence medication use behaviours. For this study, it was planned to initially assess the discriminative properties of the instrument.

3.2.1 Item Generation

3.2.1.1 Literature Review

The first step in item generation was to review the current literature on adherence and CHF to identify predictors for adherence and potential barriers to good adherence. Electronic databases of CINAHL, EMBASE, ERIC, HealthSTAR, and MEDLINE were searched using the medical subject headings of "compliance", "patient compliance", "heart failure, congestive", "drug therapy", "antilipemic agents", "antihypertensive agents", and "angiotensin-converting enzyme inhibitor". Textwords such as "predictor" and "intervention" were used to modify the search for relevant articles. The names of authors of key review articles and meta-analyses were also used to search for articles. References and bibliographies of relevant review articles, meta-analyses, and clinical trials were checked to identify articles that may have been missed in the electronic search. Previously published surveys used to determine adherence to medical regimens were also examined for relevant information.[156-158]

A standardized review template was used to abstract pertinent information from the articles.[159] Predictors of poor adherence were grouped according to the categories established by Haynes[124]: disease related, clinical setting, features of the treatment, and patient related issues (Table 2.2). Barriers to medication use identified in the literature were grouped using the Health Belief Model framework (Figures 2.5 & 2.6).

3.2.1.2 Clinician and Patient Input

Following the literature review, physicians, nurses, and pharmacists who treat patients with CHF were asked about factors that they felt would prevent patients from adhering to medications. Individual patients were asked about factors that influence their medication use during their appointment interviews with the pharmacist in a specialized heart failure clinic. Additional areas identified through these two groups were added to the list for consideration.

3.2.1.3 Focus Groups

The final stage of item generation involved focus groups. Focus group methodology was chosen because of its speed of completion, high degree of content validity, and flexibility to explore unanticipated issues that may arise.[144-146] Focus groups can be used in the initial stages of instrument development to generate items for survey questions, format questionnaires, and generate new hypotheses.[140] Another advantage to the use of focus groups was that the investigator could discover the vocabulary participants use to describe their experiences, which may become very useful in the wording of new survey instruments.[140,146]

Sample Size

The set up and analysis of focus group sessions were performed according to standard methods described by Kreuger[142] and Morgan[141]. The size of each group plays a significant role in the group dynamics. It is important for all members or the group to contribute to the discussion, as the researcher will be interested in hearing the full range of views. With larger groups, it is easier for participants to become passive and refrain from contributing.[144] A large group also has the potential to break into subgroups that

begin holding side conversations.[141,144] Important data may be lost during these side discussions because they may either disrupt recording of the main conversation or contain key information that is unintelligible. To overcome this problem, a high level of moderator involvement is required, which may not be desired for some research purposes. Although a smaller group may require less moderator involvement, participants who wish to dominate the conversation can easily disrupt them.[141] Smaller groups run the risk of becoming stagnant, especially when participants are not interested in the research topic. Also with fewer participants, the researcher may not have adequate representation from the population they are interested in.[142]

There are no set guidelines for the correct size of a focus group. However, it is generally recommended to have five to ten participants.[141,142,145] This size provides enough opportunity for each participant to contribute to the conversation, while allowing for enough members to create a diversity of opinions and experiences. It is also recommended to over-recruit for each group in order to allow for no-shows.[141]

It is difficult to predict how many groups will be needed during the planning stages, so as a general rule, qualitative research proposals should allow for some flexibility.[144] Practical issues such as number of researchers, time, and funding can influence the number of groups. One major influence is the amount of data required and generated from the focus groups. Usually, researchers start with three to five groups and modify this number until they have reached data saturation.[141] The researcher can stop holding focus group sessions when data collection reaches saturation; in other words further sessions will not generate new ideas. Fewer focus group sessions are required

when the objective is to explore and identify issues leading to the development of a questionnaire.[145]

In this study, it was decided to hold four sessions with five to seven participants in each session. Participants in the first three focus groups were patients attending the University of Alberta Heart Function Clinic, Edmonton, Alberta. The clinic is managed by a multidisciplinary team of physicians, specialised nurse practitioners and pharmacists to provide an optimum level of wellness for ambulatory patients with congestive heart failure. Participants of the fourth focus group were from a family practice clinic at the Grey Nuns Hospital, Edmonton, Alberta. The clinic nurse recruited participants using a script (Appendix 1) to invite patients to attend a meeting where they would discuss their experiences with medications. Symptomatic and asymptomatic patients were approached to provide a variety of participant characteristics. The nurse indicated that other patients from the Heart Function Clinic would attend the meetings and that all participants were taking medications for heart failure. Participants from the fourth focus group were from an academic family medicine clinic at the Grey Nuns Hospital, Edmonton, Alberta. Patients from this clinic were recruited through a letter requesting voluntary participation in a meeting to discuss medication use.

Question Map

During each focus group session, the participants' opinions and beliefs regarding barriers to medication use were explored using a funnelling technique. A script was used to maintain consistency of the opening remarks and instructions (Appendix 2). A question map (Appendix 3) was used to ensure that the groups covered a list of pre-defined issues.[142,145] There are several types of questions used in a focus group, each

with its specific role. The opening question, or "ice-breaker", should be easy to answer. Each participant should be given an opportunity to answer as it will introduce the participants to one another and also highlight some of the common features they share.[142,144] Introductory questions give the participants an idea of the general topic of interest. These questions provide an opportunity to reflect on common experiences and provide background information to the researcher.[142] Key questions are the main reason for the focus group. Since the researcher is most interested in the responses to these questions, they are usually developed first and require the greatest amount of time to phrase.[142]

When stimulus material is used, the moderator must carefully choose questions that will not limit or restrict the participants' responses.[141] One approach is to begin with an uncued question, which is an open-ended question that does not contain cues or examples. The respondents will typically base their response on recent or remarkable experiences or impressions.[142] Cued questions, providing specific examples and incorporating a stimulus may be asked after the topic has been discussed in a general fashion.

Three questions were asked to move the participants from a general discussion of CHF towards the specific area of interest, barriers to medication use (Appendix 3). First, participants were asked to describe how their life has changed since the diagnosis of CHF. This question was intended to "break the ice" and learn the language participants use to describe their condition and experiences. The second question lead the discussion to the use of medications by asking: "What have you done to include taking medications into your daily routine?" The third question was the key question; participants were

asked: "What are some difficulties that you or anyone you know have encountered when taking medications as they were prescribed?" Once the participants had discussed their difficulties in a general way, cued questions were asked to explore barriers mentioned in the session and identified in the literature. Specific areas explored included known benefits of medications, experiences with adverse events, cost of medications, and relationships with healthcare providers.

Data Collection and Analysis

Basic demographic information including age, sex, duration of CHF and concurrent diseases was collected from clinic charts of all participants. Patients also reported their medication use behaviour.[74] Data collection during the focus group sessions involved tape recordings of each session as well as field notes taken by the researcher during the sessions. Recording focus group sessions is very common and highly recommended.[144,145]

The cassette recording for each session was transcribed for evaluation. Analysis of focus group data can be quite time consuming as the transcripts from one focus group can be 50 to 100 pages long, depending on the length of the session.[142] A systematic approach with the use of a code map is preferred in order to maintain focus on the research question during analysis.[148] Code maps are used to record the criteria used for inclusion into each theme and thereby maintain consistency of interpretations.[148] A second method for ensuring consistency of the analysis is to use multiple reviewers for evaluation of the transcripts. Agreement among the reviewers helps verify that the interpretations are consistent and that conclusions from the data are reliable.[148]

The principal investigator reviewed transcripts and field notes to identify key phrases. Each phrase was given a label. Once labelling was complete, similar statements were grouped into themes. A code map was developed to track the data analysis and maintain consistency of definitions for each theme.[148] This open coding method allowed for easier arrangement of specific barriers identified by patients with CHF. A second investigator checked the coding and classification system to verify the coding method.

3.2.1.4 Summary of Item Generation Phase

Data gathered from the literature search, discussions with health care professionals, individual patients, and focus group participants were grouped into five themes. These five themes were: relationship with the healthcare professional, patient knowledge (of both disease and treatments), previous medication experiences, patient support, and communication. Focus group data were used to determine the relative importance of each item. For example, the frequency that an item was mentioned and the duration of time spent discussing the item were used as indicators for importance. Items were reviewed for redundancy and a final list of items was generated to form questions for the instrument (Appendix 4).

3.2.2 Questionnaire formatting

The format of this instrument was based on previous questionnaires, such as the Diabetes Activities Questionnaire[158], Trust in Physician Scale[132], and Patient Satisfaction Questionnaire[160]. These instruments use a mixture of positive and negative stems within each pre-defined domain and use either a 5-point response scale[132,160] or a visual analog scale[158]. Several reference texts were also used to guide formation of the questions and

overall questionnaire format.[139,143,149] The instrument was divided into four sections (Appendix 5):

Part I: General Demographic Information

Part II: Patient-Reported Medication Use Behaviour Scale

Part III: Minnesota Living with Heart Failure Scale

Part IV: Barriers to Medication Use Scale

3.2.2.1 Barriers to Medication Use Question Stems

Within each theme of barriers to medication use, the items were formed into questions using language and quotations from the focus group data wherever possible. As the questions were formed, they were grouped according to the type of question asked. Depending on the item, a stem was formulated to determine either agreement or frequency. For example, within the theme of social support, an item of interest was the assistance a patient receives from immediate family. The stem "My family never helps me take my medication." was created to ask for agreement. Several items were used to create stems asking for frequency. For example, within the theme of communication, "How often is medical information explained in a way that you can understand?" was to determine frequency.

3.2.2.2 Barriers to Medication Use Response Options

Likert and visual analog scales can be used for discriminative instruments.[140] Five-point Likert-type response options were used for each item in the barriers section of this instrument. This scale was used to maintain consistency between different sections of the instrument and because the Likert scale may be easier to interpret than the visual analog scale.[161] For example, the visual analog scale requires some degree of objective

assessment as to where the subject's mark appears on the line. The response options for agreement questions were:

1) Strongly Disagree
2) Disagree
3) Neutral
4) Agree
5) Strongly Agree

Response options for the frequency questions were:

1) None of the time
2) A little of the time
3) Some of the time
4) Most of the time
5) All of the time

3.2.2.3 General Health Rating Question

A general health rating question was included in the demographics section: "In general, how would you rate your health over the past 4 weeks?" The response options were: excellent, very good, good, fair, and poor.[162]

3.2.2.4 Patient-Reported Medication Use Behaviour Scale

Patient self-reported adherence rates were recorded using a modified scale previously published by Morisky et al.[74] This scale was selected for its simplicity and speed of assessment. Four questions are used to discriminate between patients with good and poor adherence rates. However, the dichotomous response options of the original

scale may limit its discriminative ability.[143] A multiple-choice scale, such as a Likert-type response scale may enhance the ability of this instrument to identify different levels of adherence and therefore expand its utility.[140,143] Response options were therefore changed to a five-point scale To provide consistency in the level of response, arbitrary definitions were used to characterize the frequencies. The response options for this section were:

1) Never (<1 time per month)
2) Rarely (once per month)
3) Sometimes (2-3 times per month)
4) Often (1-3 times per week)
5) Always (>5 times per week)

3.2.2.5 Health-Related Quality of Life in Congestive Heart Failure

The Health Belief Model suggests a patient's perception of disease severity may affect their sensitivity to barriers to medication use.[28,29] The Minnesota Living with Heart Failure (MLwHF) questionnaire is a well-validated disease-specific quality of life measure.[163,164] This survey was selected because it was considered a standard measure of patient-perceived CHF severity. The 21 items cover physical, socioeconomic and psychological factors that patients with CHF may encounter.[163,164] A score based on the patient's ranking of each item is used to quantify the extent of impairment due to CHF.

3.2.2.6 Method of Administration

This instrument was developed to be self-administered.

3.2.2.7 Questionnaire Scoring

Barriers Scale

Patient responses on the ordinal, 5-point scale were converted to an interval scale to facilitate comparability of different scales. Prior to calculating a summary score for each theme of barriers, questions with negative stems were re-coded so that all responses were in the same direction (i.e. 1=barrier is not present; 5=barrier is present). The questions were grouped into five themes as discussed above. Table 3.1 displays the question numbers corresponding to each barrier to medication use theme (Appendix 5).

Table 3.1 Question Groupings for the Barriers Scale

Theme of Barriers	Question Numbers
Relationship with Healthcare Professional	28 – 31
Patient Knowledge (of both disease and treatments)	1 – 5
Previous Medication Experiences	6 – 12, 24, 26, 27
Patient Support Mechanisms	13 – 20
Communication	21 – 23, 25

The theme-specific scores were converted to a 0 to 100 scale using the following formula: [(observed score – minimum score) /(maximum score – minimum score)] * 100. High scores indicate that barrier(s) to medication use are present within that theme. This process is illustrated in the following example:

Questions 28 to 31 explore the patient's relationship with their healthcare provider. The possible response scores for the 4 items in this category range from 4 to 20. If a respondent has an observed score of 14, the corresponding score on the interval scale would be ((14-4) ÷ (20-4)) x 100= (10/16) x 100 = 62.5.

General Health Question

The general health rating question was recorded on an ordinal scale. The responses were converted to an interval scale using the Thurstone Method of Equal-Appearing Intervals.[162]

Excellent	5 (raw score)	100 (on the 0-100 scale)
Very good	4 (raw score)	84 (on the 0-100 scale)
Good	3 (raw score)	61 (on the 0-100 scale)
Fair	2 (raw score)	25 (on the 0-100 scale)
Poor	1 (raw score)	0 (on the 0-100 scale)

Patient-Reported Medication Use Behaviour Scale

Patient responses to the four questions for the self-reported adherence scale were converted to an interval scale using a similar formula as described above. For example, the possible responses to the four questions in this section range from 4 to 20. If a respondent has an observed score of 18, the corresponding score on the interval scale would be $[(18-4) \div (20-4)] \times 100 = (14/16) \times 100 = 87.5$.

Minnesota Living with Heart Failure Scale

The scoring system for the Minnesota Living with Heart Failure scale[163] was reversed and converted to a 0 to 100 scale. By this method, patients perceiving that their burden of CHF is quite severe would have low scores and those with minimal disease severity would have high scores. This method is similar to that used to facilitate comparison of the Minnesota Living with Heart Failure scale to other scales.[165]

3.3.0 Instrument Testing

3.3.1 Patient Recruitment

For the instrument testing phase, patients were recruited from the Heart Function Clinic at the University of Alberta Hospital. Patients are referred to this clinic by their family physician, internist, or cardiologist for management of CHF. During their appointment at the clinic, patients can see a physician specialist, nurse, and pharmacist. Patients are seen by appointment with the frequency of follow-up dependent on the severity of the patient's symptoms.

Consecutive patients attending the clinic for their appointment and those attending a patient teaching session were eligible for recruitment into the test phase. Those who were unable to read and understand English and those who were acutely ill, based on clinical judgement, were excluded. Furthermore, data from those who were unable to complete the questionnaire, or refused to provide pharmacy contact information were not used.

For sample size calculation in reliability and validation testing, it is acceptable to use an approximation.[143] To estimate a Pearson correlation coefficient of 0.7 with a 95% confidence interval of 0.1, a sample of between 100 and 150 subjects would be required (Refrence 143: Figure 8.4, Page 125). Sample size in this study largely depended on the ability to recruit patients in a busy ambulatory care clinic. A judgement call was made based on an estimate that 100 patients were seen monthly and that 10% would be excluded or refuse to participate. During a six-week recruitment phase, it was expected that 120 patients could be enrolled.

For test-retest reliability testing, it was expected that the correlation would be quite high (r>0.8), therefore a sample size of 30 was required (Reference 143: Figure 8.4, Page 125). To accommodate for non-responses to the follow-up survey, the first 40 patients who returned the first survey were sent the second survey (Appendix 6).

3.3.2 Data Collection

The clinical data were collected routinely as part of each clinic visit. Values from the most recent clinic visit were used. The pharmacy contact form was used to collect clinical data as well as refill frequency data from the patient's community pharmacy (Appendix 7). Based on a review of the adherence literature and discussions with the Heart Function Clinic clinicians, the following clinical variables were collected for each patient:

1) New York Heart Association Functional Classification
2) Date of initial visit to the Heart Function Clinic
3) Co-morbid cardiovascular diseases (previous acute myocardial infarction, angina, hypertension, diabetes, atrial fibrillation)
4) Number of hospitalizations within the previous 12 months

Demographic information was collected as part of the self-administered survey. Variables included gender, age, marital status, duration of CHF, highest level of education achieved, yearly household income, and race. The numbers of prescription medications, over-the-counter medications, and herbal products were requested to determine if the number of medications taken daily influenced the adherence rate.

The modified Morisky self-reported medication use behaviour scale, MLwHF, and barriers to medication use were self-administered by the patient. To ensure a high response rate, patients were recruited in the Heart Function Clinic during their appointment. Whenever possible, patients were asked to complete the survey during their appointment. If this was not possible, a self-addressed, stamped envelope was provided.

A standard case report form was used to collect information on refill frequency for medications used to treat CHF (Appendix 7). The patient's community pharmacist was notified (Appendix 8) and subsequently contacted to collect refill frequency information for angiotensin converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), beta adrenergic receptor blockers, diuretics, spironolactone, amiodarone, combination of a nitrate and hydralazine, and digoxin. The pharmacy was asked to provide a dispensing history (date of refill, quantity, and patient instructions) for these medications during the past 6 months. A time period of 6 months was selected to ensure an accurate estimation of the adherence rate.[61,70,82,83] Several different intervals or exposure time-windows have been used in previous studies.[82] In Alberta, patients can receive a 90-day supply of medications. The six-month window would allow for at least two opportunities for the patient to refill his or her prescriptions.

The pharmacy refill information was used to calculate a percentage of days covered for each medication. The number of days supplied (calculated as quantity divided by patient instructions for a daily dose) for each refill during the six-month period was summed, divided by 180 days and multiplied by 100. Adherence rates for regularly scheduled agents (ACE inhibitors, ARBs, beta-blockers, digoxin, amiodarone, and spironolactone) were compared before aggregation. As there is variability in the

dose and administration frequency of diuretics, especially furosemide, the adherence rate for this agent was not included in the aggregate score for adherence rate.[32]

3.3.3 Statistical Analyses

3.3.3.1 Reliability

The purpose of reliability testing is to measure the extent to which scores on the instrument truly represent the attributes of interest. In other words, reliability testing will determine if the level of noise (both random and systematic errors) is too large for the instrument to detect the signal of interest.[140] Reliability of this instrument was tested in terms of internal consistency and stability over time. Internal consistency was assessed using Cronbach's α coefficient.[150] An α coefficient of greater than 0.7 is considered an acceptable level of internal consistency for between group comparisons.[152]

Stability of responses over time was measured by test-retest. The instrument was administered on two occasions separated by at least 14 days. The first 42 consecutive patients who returned the first survey were mailed a second copy of the questionnaire (Appendix 6). To increase the likelihood of response to this mailing, the second questionnaire contained only the sections essential for this test: Part II (Use of Medications) and Part IV (Barriers). Patients were asked to return the questionnaire in a postage-paid envelope to the EPICORE Centre, University of Alberta, Edmonton, Alberta. The intraclass correlation coefficient was calculated to assess test-retest reliability.[153]

3.3.3.2 Validity

Assessment of validity is necessary to ensure that the instrument is actually measuring the intended traits. There are four attributes of validity – content validity, face validity, criterion validity and construct validity. Focus groups were used in this project because of their high level of content validity and acceptance as an initial step in questionnaire development.[140,141] To evaluate face validity, the instrument was circulated amongst members of the University of Alberta Heart Function Clinic, faculty members from the Faculty of Pharmacy and Pharmaceutical Sciences, and participants in the final focus group. Recipients were asked to evaluate the questionnaire for its appearance and to ensure that important factors regarding medication use were not missing.

Assessment of criterion validity ensures that there is a correlation between a new instrument and a 'gold standard'.[143] Currently there are no instruments available in the literature to detect barriers to medication use. With the absence of a gold standard for direct comparisons, assessment of criterion validity was not possible in this study.

Constructs are underlying factors that influence an observable behaviour.[143] Theoretical links between observed behaviours and constructs are used to generate hypotheses for testing. The Health Belief Model was used to provide a framework for characterizing the link between perceived barriers and medication use behaviour.[28,29] This model is one of the most widely used in adherence research and provides a broad basis of exploring links between patient beliefs and observed health-related activities, such as adherence to medication. To strengthen the process of construct validation, the direction of correlation was hypothesized *a priori*.

Primary Hypothesis:

Within the Health Belief Model, "perceived barriers" is the most powerful and consistent dimension for explaining health behaviour.[29] Construct validity was evaluated in this study by testing the association between the degree of perceived barriers and level of adherence. A negative association was expected in that a patient who has a high level of perceived barriers will have a very low level of adherence. Conversely, a patient with few perceived barriers will have a high rate of adherence. Perceived barriers were identified and quantified using questions generated from previous focus groups.[32] The level of adherence was measured using pharmacy refill frequencies.[61,70,71,81]

Secondary Hypotheses:

Patients who are asymptomatic are less likely to engage in preventive medical practices such as adherence to medications because their level of perceived susceptibility to and severity of the disease are too low to motivate behaviour.[28] Conversely, very high levels of perceived severity can be inhibiting to preventive medical practices because of overt fear.[28] Although both extremes may be associated with low adherence levels, several studies have demonstrated that the patient's view of disease severity can be a strong motivating factor for adherence.[29] The association between perceived severity of and susceptibility to CHF and rate of adherence was examined. The MLwHF was used to quantify the patients' quality of life as a surrogate for their perception of CHF severity and susceptibility to the condition.[163,164] Pharmacy refill frequency data was used to measure adherence rate.[61,70,71,81] This association was assessed with the expectation that patients with a higher quality of life would have a higher level of adherence. In a similar fashion, it was hypothesized that a patient with a higher quality of life may have fewer

barriers to medication use. The association between the MLwHF score and perceived barriers was assessed with the expectation that there would be a negative association. Given the complexity of perceived susceptibility and severity of disease in the Health Belief Model, both associations were anticipated to be weak.

Previous work by Morisky et al. demonstrated that the four-question self-reported scale had good concurrent and predictive validity.[74] There was a moderate correlation (r=0.43) between the self-reported adherence score and control of blood pressure. The scale also demonstrated reasonable predictive ability. The modification to a five-point Likert response option was postulated to improve both aspects of the scale. The concurrent validity of this modified scale was tested with the assumption that there would be a positive correlation between the two adherence measures. The self-reported adherence score, converted to a 0-100 scale was compared to the adherence level measured from pharmacy refill information. The predictive ability of the modified scale was tested with the assumption that the patient's self-reported level of adherence will predict the percentage of days covered.

Data Analysis

The Pearson product moment correlation coefficient was calculated for all pairs of continuous variables. A chi square test was used to test the predictive ability of the patient's self-reported level of adherence. A two-by-two table was set up by dividing patients reporting high or low medication use behaviours (from the four-question self-report scale) on the vertical axis and high versus low percentage of days covered on the horizontal axis. An arbitrary cut point of 80% was used to dichotomize patients because of its relative acceptance in adherence literature.[52,53] Although this cut point was

established in adherence studies involving hypertension, its applicability to CHF is unknown. The level of significance for all statistical tests was set at $p<0.05$. The strength of association was characterized using arbitrary cut points that were established based on previously reported levels.[132,160] A strong correlation was considered above 0.7, moderate if between 0.4 and 0.7, low if between 0.2 and 0.4 and poor if less than 0.2.

3.4.0 Ethical Considerations

Ethical approval for the focus group stage was obtained from the University of Alberta Health Research Ethics Board (Biomedical). Ethical approval for the instrument testing stage was obtained from the University of Alberta Health Research Ethics Board (B: Health Research). Nurses in the Heart Function Clinic made initial contact with potential subjects. Participation in both stages was voluntary and written consent (Appendix 9) was obtained prior to commencement of data gathering. All subjects were informed of the study's purpose, expected procedures, as well as the benefits and risks of participating. The subjects were advised that they could ask questions about the study and choose to withdraw at any time.

At the beginning of each focus group session, the researcher requested both verbal and written consent. Although participants were quite receptive to this, both forms of consent were required for the researcher to use the data in subsequent analyses. Data from the focus groups have been published with responses reported in an anonymous format.[32]

To maintain confidentiality during the instrument testing stage, study numbers were used to identify all case report forms and surveys. Once refill frequency

information was obtained from the subject's community pharmacy, his or her name was covered up using a black felt pen. Data were kept in a locked file accessible to only the researcher and his committee and will be destroyed five years after completion of the study. All presentations, reports, and publications of the findings were produced in an anonymous aggregate format.

Chapter 4

Results

4.1.0 Focus Groups

4.1.1 Participant Description

Four different focus groups were held.[32] The first three focus group sessions were conducted with seven participants each. Participants were recruited from the Heart Function Clinic at the University of Alberta Hospital in Edmonton. The fourth focus group session consisted of five participants recruited from a family practice clinic at the Grey Nuns Hospital in Edmonton. The mean age of participants was 66 years old with a range of 31 to 86 years old. According to a self-reported adherence measure, participants had a medium (1-2 positive responses) to high (0 positive responses) level of adherence.[74] Participants had similar characteristics to other Heart Failure Clinic patients[166] with respect to age, cause of CHF, and New York Heart Association classification (Table 4.1).

Table 4.1 Focus Group Participant Demographics

	Heart Function Clinic (n = 21)	Family Practice (n = 5)	Heart Function Clinic Patients[166] (n = 292)
Age	65 (12)	70 (11)	66 (14)
Male	52%	60%	68%
Etiology:			
Ischemic	62%	60%	67%
Ideopathic	28%	40%	23%
Other	9%	0	10%
Duration of clinic follow-up	3.9 (2.5)	6.2 (6.4)	1.5 (1.3)
NYHA class:			
I	19%	20%	24%
II	62%	80%	50%
III	19%	0	23%
IV	0	0	3%
Number of Prescription Medications	9 (3.5)	5 (1.1)	N/A
Concurrent Illnesses:			
Diabetes	14%	20%	22%
Systemic Hypertension	29%	40%	28%
Prior Myocardial Infarction	57%	60%	51%
Atrial arrhythmia	29%	40%	29%

4.1.2 General Background Findings

Participants identified numerous issues related to CHF and drug therapy, indicating their varied experiences with the disease and its major impact on their lives. They confirmed that CHF created a significant change in their life and intruded into daily activities. Before developing CHF, many participants led busy, active lives and enjoyed many recreational activities, such as golfing, bike riding and walking. After the diagnosis, they became sedentary and felt tired all the time. Participants reported that this was extremely frustrating for them because they had to stop many activities that they once enjoyed, or lost interest because they were so tired. Some noted that they missed the ability to work or do yard work like shovelling snow, mowing the lawn, and trimming the hedge.

Several participants recognised the limitations that CHF had placed on their activities. They developed coping mechanisms to recognise symptoms of heart failure

and learned what activities precipitated these symptoms. Some participants also highlighted the role that their attitude plays on their health. One participant felt that it was important to identify that she was ill with CHF, but that does not mean she had to be sick. Participants noted that a sense of good humour, being cheerful and taking time to enjoy the “process of staying alive” had significant effects on their condition. These positive approaches were especially needed when they were feeling overwhelmed by the symptoms of CHF.

One drug used to treat CHF was identified as having a significant impact on all participants –furosemide (Lasix®). All participants were familiar with its purpose and effects, and almost all reported having to make changes in their daily routine to accommodate the diuretic effects. For example, some participants reported adjusting the dosage or time of administration to attend meetings or take long trips. This would avoid the embarrassment of leaving an event at an inconvenient time or causing a disruption. Many participants reported the need to be familiar with the location of public restrooms and planning their walks in order to be close to a bathroom if required.

The focus groups helped to identify how patients describe their medical condition and the effects of their treatment. Participants provided perspectives on how CHF has affected their bodies and what happens during an exacerbation of CHF symptoms. The insight gained from listening to the participants’ descriptions assisted in writing the survey questions.

- *"I think of (the body) more as a recipe for a cake and if you put too much of something or not enough of something else in it…look what happens sometimes. The cake will go all over the oven…it's really important that drug A is compatible with drug B or else the cake falls."*

- *"I look at the human body as a chemical manufacturing system which manufactures the chemicals you need. So if you're short of potassium, or you have too much sodium…become askew so that the medical profession orders more drugs in order to straighten that out."*

- *"I've had this for 14 years. I've had 4 serious attacks, a couple of little ones, one last week actually to get the fluid off my liver, lungs and heart because my heart is quite enlarged."*

4.1.3 Barriers to Medication Use

Participants discussed several issues that affected their adherence to medications. These issues were grouped into five themes: 1) relationship with a health care professional; 2) patient knowledge; 3) prior experience with medications; 4) social support; and 5) ease of communication. Items generated from these focus groups are listed in Appendix 4. Elements discussed in each of these themes are described in more detail below.

4.1.3.1 Confidence in Healthcare Professionals

Many participants commented on the essential role healthcare professionals play in the maintenance of good health. Healthcare professionals were perceived as resources to provide information on achieving good control and long-term management of their disease. Participants remarked that it was important to ask pharmacists, nurses, and physicians about their condition and the medications they take. Information that was felt to be important included the reason for taking a drug, potential interactions with other drugs or foods, adverse effects, and flexibility with dosing times.

- *"Do you talk to your pharmacist? Because I know it doesn't take too much time to tell me not to take this one with that one and take this many together at this hour."*
- *"I ask my druggist every time – if this (drug) will be friendly with this."*
- *"...the doctor will tell you this is for your heart but I think it's up to the pharmacist to explain to you how you take it, when you take it, etc."*

Participants also emphasised the need for healthcare professionals to be knowledgeable and show genuine concern for their well-being. Participants indicated that there had to be a level of trust with the healthcare professional, which could be established through an ongoing relationship. When the healthcare professional appeared to be uninterested in what the participants had to say about their condition, they were less likely to follow that healthcare professional's advice.

- *"You have to have faith in your doctor."*
- *"If you don't have trust, you've got to find another doctor."*
- *"Are you getting all your pills at the same pharmacy? That is a good plan to because then they will know exactly what you are taking then."*
- *"I felt a stabbing sensation in my chest...I told (but he) didn't seem to be too concerned...I go and hide and sit in the chair and just fear about this here pain. I know (they) won't do anything because ... (they don't) seem to be too concerned."*

4.1.3.2 Patient Knowledge

Participants discussed the importance of learning everything they could about their condition and the medications they take. During the early stages of the disease, patients may be more interested in reading all the information that is available. As they become more aware of their condition, information resources become useful as quick references for answering specific questions. The purpose, expected benefits, adverse effects, tips for management of adverse effects and special instructions for specific

medications were felt to be key pieces of information. Participants felt that a well-informed patient was more likely to remain adherent to medications.

- *"If I'm going to take it, I want to know what it's going to do."*
- *"Do I take it with or without food, a simple thing like that. What time of day works best and is there any elasticity within that?"*
- *"I'm on coumadin. Not eat this, not eat that. I was told you'd have to eat a bushel for it to affect you. Don't eat for 2 hours, that helps."*
- *"Another thing that may be useful…is some kind of plan or suggestions on how to handle travel. If I am going to break a routine and travel, is there something you can do…time zones are involved some times."*

Conversely, when patients do not know what the medications were or their purpose, they were more likely to stop taking them.

- *"I think that with a lot of seniors that when they feel well…they quit taking (medications)."*
- *"Sometimes I feel so good I think I could cut some of (my medications) out."*
- *"How many have been in emergency when they ask the person beside you (what are you taking) and they say 'I take a red one in the morning and a yellow one at lunch.' Some people have no idea."*
- *"I take 17 pills a day. I don't know what they all do."*

One final element of patient knowledge that the participants discussed was their ability to ask questions. Several participants indicated that important information may be missed when patients forget to ask, or do not recognise that they need to ask about some things. In general, participants reported that when they did ask a question, they hoped to get an answer from the healthcare professional, or at the very least, some direction. They did not appreciate having questions ignored or not answered.

- *"That is something that the patient needs – about drug interactions – but doesn't often ask."*
- *"My trouble is I don't know what to ask."*
- *"I don't know what to ask...Some things I ask...I just don't know what is important."*
- *"...not the right ones or not asking the right questions"*

4.1.3.3 Previous Medication Experiences

As with most opinions, prior experience (either good or bad) can influence attitudes. Focus group participants were very willing to share the effects they have experienced from their medications. Discussions in all four focus groups centred on the adverse or undesired effects of the prescription medications. Fatigue was the most common effect reported, with most participants reporting that they sometimes altered medication use to avoid overt fatigue. As mentioned previously, the diuretic effects of furosemide are well known and were considered somewhat bothersome by almost all participants.

- *"My medications just bum me out. I am useless during the day."*
- *"Some people stop taking (medications) when they get a reaction."*
- *"I get so tired and I can notice it so quickly. 45 minutes after taking the pill (Lasix®) I feel like I've had it. So why take it? I've stopped taking Lasix for that reason even though I know I should take it to get rid of the fluid."*
- *"I can't seem to shake off this tiredness and I don't know if it's my medication that's causing me to be tired."*

Participants also discussed their perceptions of drug effectiveness. They acknowledged the fact that prescription medications will not "cure" their disease, however many commented on an expectation that new drugs should provide some

tangible benefit. They expected to feel better, stronger and less tired when they are started on a new medication.

- *"The sense of well being and being able to do a lot more things...this is just wonderful."*
- *"I don't see no single benefit of my medication...I don't notice if I'm feeling better, stronger, I'm still sick."*
- *"I'm on some kind of an experimental drug to which I'm supposed to have all these side effects. I'm positive that I've got a placebo because it's supposed to make me feel better and I don't feel a bit better at all...see, I wanted to get on that study because I wanted to feel a little bit stronger..."*

The cost of therapy may be a major factor in patients' decisions to adhere. Participants in the four focus groups reported that, in general, cost was not a major issue as long as they had adequate healthcare coverage. Cost of medications becomes a major issue for all patients when new drugs that are not yet covered by healthcare plans are started.

- *"Cost is not a problem when you're covered."*
- *"Some of the newer medications are not covered...there's no question it's a problem."*
- *"For some people the cost is prohibitive for getting the medication they require."*
- *"(Cost) does play a part with quite a few people...I'm quite sure there must be people who find it really cuts into their family budget."*
- *"The new drugs...are extremely expensive."*
- *"The reason it doesn't bother me is because I'm on DVA (veteran's benefits) and they cover everything."*

One participant summarized the dilemma many people have when faced with high-cost therapies for their conditions:

- *"You cut down on the food part to get the drug part."*

4.1.3.4 Social Support

The participants identified three sources of support: 1) immediate family and close friends, 2) support groups consisting of people with similar conditions, and 3) healthcare professionals. Participants felt it was important to involve spouses and other family members in the education of their disease and the medications they take. This information was helpful so that their family would understand the disease process and also help reinforce the need to take medications. One group shared strong opinions regarding “helpful” friends offering herbal medications. In general, there was a distrust of the herbal remedy claims. However, the participants found it hard to refuse help and advice from their friends.

Support groups may be important so that patients can recognise they are not alone. In fact, the focus groups themselves were perceived as a first step for some participants to meet with others to learn that they have similar questions and concerns. All four focus groups suggested that a healthcare professional be present at the meetings to act as a resource for specific questions. The participants felt that meeting in a group environment would give them a chance to ask questions, learn more about their disease and learn what others do to cope. The meetings would also serve as a reminder to continue the good habits of their health care, like adhering to medications.

Healthcare professionals were the third source of support discussed in the focus groups. Participants reported that they rely on doctors, nurses and pharmacists to give them information and help them manage their disease. Qualities associated with a ‘good’ contact person are a true sense of caring for the patient’s concerns, knowing the patient’s history and taking time to listen. The participants stressed the importance of getting to

know their contact people very well to establish a level of trust. Once a relationship is established, this becomes a motivating factor for maintaining compliance. When others are involved and appear to be very interested in their healthcare, the participants tended to be more careful with following the advice on lifestyle changes and adhering to their medications.

4.1.3.5 Ease of Communication

Participants in the focus groups acknowledged that healthcare professionals strive to provide the best available information. However, valuable information may be lost in the language used for communication. Some participants remarked that they were more interested in the general results of tests along with an explanation of possible reasons for a high or low result; they felt the exact numbers had little value to them.

- *"I think you want to know what the results are...the numbers don't mean a damn thing to me, to a doctor or a nurse who is capable and knows what they mean, they should say 'Well, your potassium is too high, rate of coagulation is too low, that's all you really want to know."*
- *"As long as you get the stuff, or at least get it explained in a language that people can understand. There are some that talk in medical terms...or drugs in pharmaceutical nomenclature doesn't mean a darn thing really."*

Furthermore, when explaining medication effects, participants felt limited in their ability to tell healthcare professionals exactly how they felt.

- *"They asked me once how you reacted to medicine, I said...I was full of Mexican jumping beans...because we don't know how to describe in medical terms."*

4.1.4 Adherence Tools

Participants were asked for their opinions on various tools used to improve adherence to medications. Specific examples circulated and discussed included written

materials, medication storage/reminder devices, wallet cards, and telephone follow-up. In general, participants indicated the pamphlets and brochures used to provide written information were valuable and greatly appreciated. They felt these items were useful for two reasons: as a source of information to learn more about their disease and medications, especially during the early stages; and as a reference to refer to for quick answers.

- *"These are good when you are initially diagnosed. You want to read everything you can on the condition."*
- *"I've got a record, you know if I'm not too sure I can go back and check."*
- *"You begin to understand something and you look back at it and read it…it's a good thing to have something to refer to."*
- *"I think there's a tendency to listen to (verbal instructions) and it goes in one ear…it's better to have it on a piece of paper that you can refer to again."*

Medication storage/reminder devices (e.g., Dosett®) were considered useful for various reasons. Almost all participants commented that these containers were valuable reminders that medications were taken. After dealing with disease for several years, medication use can become routine, with patients finding it difficult to remember if they have taken their medications for a specific time. Distractions often occur and participants reported that it was often easy to miss a dosage time because the phone rang, or they got busy with other things. By looking at the storage device, patients can determine whether or not they took their medications for a specific time. Interestingly, some participants invented their own forms of reminder devices such as medication cups and tart tins to ensure medications were taken throughout the day. Smaller containers or weekly

dispensers that have containers for individual days were considered useful for patients to take along with them during their daily travels.

- *"So the phone rings, or something drastic happens…how are you going to remember you took (your medications)? There will come that day that you don't remember. It is so routine like brushing your teeth…now did I take my pills or didn't I?"*
- *"I've only been doing this for 20 years. It was good for the first 10 years. Then all of a sudden it was like 'okay it's 10 o'clock and did I or didn't I (take my medication)? Because you have done it so often, day after day, and you cannot be sure."*
- *"I've been using (medication dispensers) for a long time. I think they're just the greatest thing. That way I can put them in there and only have to think once a week...you're not constantly wondering, did I take them?"*
- *"I start out with three or four pill cups for the day, then I know if I have taken them at the end of the day."*
- *"You know when you take a glance at the compartments if it's empty or if it's full."*
- *"I have a little one for the day, because I don't take that many during the day. Then in the morning I have a little drill and fill them up."*

Coupled with the use of medication dispensers was the importance of scheduling dosage times around daily activities. Participants reported that it was easier to remember to take medications at regular times such as brushing teeth or meal times. Participants felt it was harder to remember to take medications when they were scheduled in the middle of the day.

- *"I find with this kind of schedule it's easier to take it with meals, that way you remember."*
- *"We all develop our own little method to taking pills. With me I have a morning, a dinner and a supper schedule."*
- *"I'm used to taking medications morning and night but not the middle of the day. So I had to make all these messages."*
- *"When I'm busy I forget. Not in the morning and not at night but during the day."*

Several participants indicated that wallet cards were very important, especially for emergencies. Almost all participants made their own list of medications that they stored in their wallet or purse. These lists were felt to be as important as having a medical alert bracelet.

- *"I write all the changes down. Someone asks 'When did you reduce your dosage?' I could say December so and so…I had it written down and you've got your history."*
- *"I didn't know there were (pocket cards). I made my own…That way when you go into the hospital and you can't even remember your own phone number…"*
- *"Well I made one for myself just because I couldn't remember things."*
- *"They list all the things that are wrong with you, all the medications you take."*
- *"I've worn it a few times…they would take my little bracelet and they would save my life. Because they've got it (the information) right there."*

As a final aid to adherence, participants were asked for their opinions regarding having a healthcare professional (such as a nurse or pharmacist) call them for follow-up and to remind them about refilling their medications. Extra contact with a healthcare professional was welcomed as long as the person calling is well known by the patient. Participants restated the value they have for a good long-term relationship with their healthcare professionals. This would ensure the person calling is familiar with their condition and their current concerns. Participants also suggested that pharmacists and nurses should check with the patient first before calling them. This would probably make the patients more receptive to a telephone follow-up program.

4.2.0 Barriers Instrument

Specific topics discussed within each theme were reviewed for inclusion in the final survey instrument. The number of questions included in each theme depended on the number of different topics introduced by the focus group participants and the length of discussion regarding each topic within the theme. Therefore areas that were of greater importance to the participants – identified by the length of discussion time spent on the topic – had more questions. A total of 31 questions were generated, with 4 questions addressing patient knowledge, 10 questions addressing previous medication experiences, 8 questions addressing social support, 4 questions addressing ease of communication, and 4 questions addressing relationships with healthcare professionals (Appendix 5).

4.3.0 Instrument Testing

4.3.1 Respondent Description

Participants were recruited from consecutive patients attending the Heart Function Clinic at the University of Alberta Hospital in Edmonton. One hundred and twenty eight patients were approached during the months of June to October 2000 and gave informed consent to participate in the study. A total of 114 of these patients (89%) returned the survey. Prescription refill information was obtained from the pharmacies for each of these patients. The first 42 patients to return the first survey were also sent a second survey for the reliability test. Of these patients, 39 (93%) returned the second survey.

The entire sample consisted of 66% men, the average age was 68.0 (SD 11.9) years with an age range between 32 to 87 years. Survey respondents reported that they

had CHF for an average of 6.4 years (range 0 to 28 years) and were followed in the HFC for an average of 3.5 years (range 0 to 11 years). The median level of education was a high school diploma and the median household income was in the $30,000 to $50,000 range. Further demographic information of the sample is provided in Table 4.2.

Table 4.2 Survey Respondent Demographics (n=114)

Age (mean ± SD) years	68.0 ± 12
Men (%)	66%
Etiology of CHF (%)	
Ischemic	74.6
Idiopathic	11.4
Other	14.0
Duration of CHF (mean ± SD) years	6.4 ± 5.4
Duration of follow-up in HFC (mean ± SD) years	3.5 ± 3.0
NYHA Class (%)	
I	21.9
II	59.6
III	17.5
IV	0.9
Hospitalizations in Previous Year (%)	
None	70.2
1-2	21.9
3 or more	5.3
Medications (mean ± SD)	
Prescription	8.6 ± 3.5
Herbal	1.6 ± 2.1
Non-prescription	0.5 ± 0.9
Total	10.5 ± 4.4
Concurrent Illnesses (%)	
Previous AMI	44.7
Angina	40.4
Hypertension	22.8
Atrial Fibrillation	14.9
Diabetes	20.2

In general, the respondents had mild symptoms of congestive heart failure, with the majority (60%) in NYHA class II heart failure and only 27% reported to have been

hospitalized at least once during the previous year. The cause of CHF was primarily ischemic (75%), with a few patients developing CHF from complications of valve disease or pregnancy (12%). The remainder had an idiopathic cause of their heart failure. With respect to comorbid diseases, 45% had a previous myocardial infarction, 23% had a documented history of hypertension, 15% had a documented history of atrial fibrillation, and 20% had diabetes.

The average number regular of medications used by respondents was 11 with a reported range of 0 to 21 medications used daily. With regard to the medications used for heart failure, 89% were on a diuretic, 87% were using an ACE inhibitor, 11% were using an ARB, 82% were using a beta adrenergic blocker, 54% were using digoxin, 43% were using spironolactone, 14% were using amiodarone, and 48% were using a cholesterol-lowering medication. The details of each class of medication are provided in Table 4.3.

Table 4.3 Medications Used by Survey Respondents (n=114)

Diuretic	
Furosemide	86.8 %
Ethacrynic Acid	0.9%
Hydrochlorothiazide	0.9%
None	10.5%
ACE Inhibitor	
Enalapril	35.1%
Lisinopril	33.3%
Ramipril	7.0%
Quinapril	7.0%
Fosinopril	2.6%
Benazepril	0.9%
Cilizapril	0.9%
None	13.2%
Angiotensin Receptor Blocker	
Losartan	8.8%
Valsartan	2.6%
None	88.6%
Beta Adrenergic Blocker	
Carvedilol	38.6%
Metoprolol	29.8%
Acebutolol	7.9%
Sotalol	3.5%
Atenolol	1.8%
None	18.4%
Lipid Lowering Drugs	
Atorvastatin	18.4%
Pravastatin	12.3%
Simvastatin	7.9%
Fenofibrate	3.5%
Lovastatin	2.6%
Cerivastatin	1.8%
Cholestyramine	0.9%
Gemfibrozil	0.9%
None	51.8%
Digoxin	54.4%
Spiornolactone	43.0%
Amiodarone	14.0%

4.3.2 General Description of Scales

4.3.2.1 Health-Related Quality of Life

Descriptive statistics for both the general health rating scale and the Minnesota Living with Heart Failure (MLwHF) scale are presented in Table 4.4. The general health

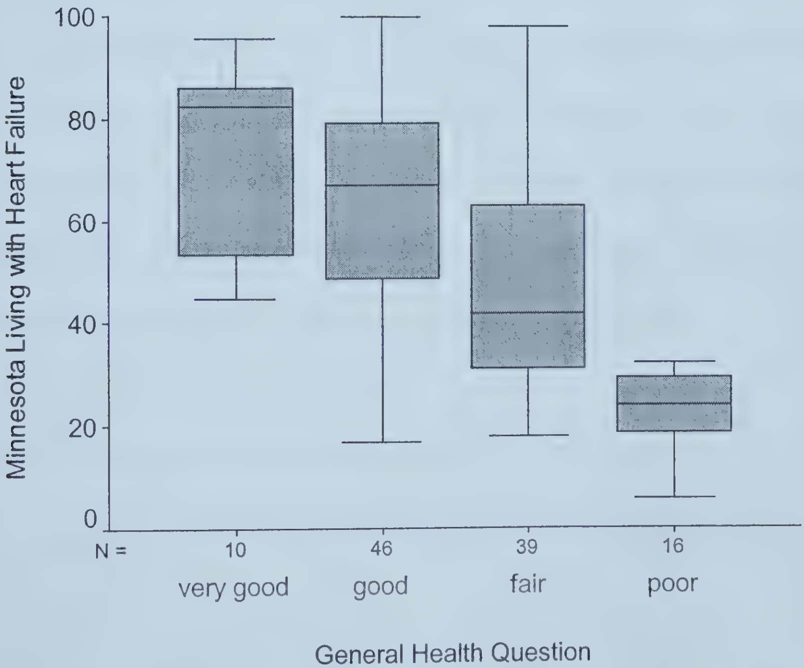
rating scale provided an overall rating of health, whereas the MLwHF provided an estimate of the patients' perceived level of health in reference to their heart failure. The association between these two scales is displayed in Figure 4.1 and appears to be continuous and graded. The estimated correlation coefficient between the two scales is 0.56 ($p<0.001$), suggesting a moderate association between these two variables.

Table 4.4 Health-Related Quality of Life Scale Statistics* (n=114)

	# of Items	Minimum	Maximum	Mean	St. Dev.
General Health Rating	1	25.0	100.0	71.5	20.4
Minnesota Living with Heart Failure	21	5.7	100.0	53.9	24.4

*Higher scores associated with good quality of life

Figure 4.1:
Association between Two Self-Reported Health-Related Quality of Life Scales



Legend for Boxplot Characteristics:
Line = Median Score
Box = Range Between 25th and 75th Percentile Values
Stem and Whiskers = Range of Extreme Values

4.3.2.2 Medication Use Behaviour

The average score on the four-question self-reported medication use scale was 13.3 with a standard deviation of 11.8. Within this scale, higher scores indicate worse medication use (i.e. 0 = excellent; 100 = poor). Within the sample, 22 patients (19.5%) reported excellent adherence, with a score of 0. The tight distribution, coupled with the range of scores from 0 to 56.3 suggests these patients felt they had a high level of adherence with their medications.

4.3.2.3 Barriers to Medication Use

The descriptive statistics for the five domains of the Barriers scale are presented in Table 4.5. High scores on this scale suggest a high level of perceived barriers (i.e. 0 = no barriers to medication use; 100 = numerous barriers to medication use). The lowest average score was for the patients' relationship with their healthcare professionals at 18.0 and the highest average score was for the patients' network of social support at 37.6. The inter-individual range for each domain was quite wide, for example scores for patient knowledge ranged from 0 to 80.0. In three of the five domains, patient knowledge, communication, relationship with the healthcare professional, the lowest score was 0, suggesting the absence of any perceived barriers in this domain.

Table 4.5 Barriers to Medication Use Scale Statistics* (n=114)

	# of Items	Minimum	Maximum	Mean	St. Dev.
Patient Knowledge	5	0	80.0	31.1	18.4
Previous Experiences	10	6.25	72.5	35.5	13.4
Social Support	8	6.25	62.5	37.6	12.1
Communication	4	0	75.0	31.8	16.8
Relationship with Healthcare Professional	4	0	62.5	18.0	14.7

*Higher scores suggest a high level of perceived barriers to medication use

The inter-scale correlation coefficients for the Barriers scale are presented in Table 4.6. All pairs are statistically significantly correlated. The magnitude of correlation is moderate ($0.4 \leq r < 0.7$) for three pairs: 1) patient knowledge and communication; 2) previous experiences and social support; and 3) previous experiences and relationship with healthcare professional. The remaining pairs have a low magnitude of correlation ($0.2 \leq r < 0.4$).

Table 4.6
Inter-Scale Correlation Coefficients for Barriers to Medication Use Scale (n=114)

	Previous Experiences	Social Support	Communication	Relationship with Healthcare Professional
Patient Knowledge	0.307*	0.334*	0.617*	0.315*
Previous Experience		0.545*	0.289*	0.405*
Social Support			0.336*	0.361*
Communication				0.406*

*p < 0.01

4.3.2.4 Proportion of Days Covered

Descriptive statistics of the adherence rate estimated by the proportion of days covered are displayed in Table 4.7. In general, participants in this study had a very high rate of adherence to their medications, with many patients obtaining refills prior to depletion of their supply. With the exception of amiodarone, more than 1/3 of patients had adherence rates greater than 100% for each drug. During collection of the pharmacy refill data, it became apparent that estimates for adherence rates of ACE inhibitors and beta-blockers may have been inaccurate due to numerous dosage changes. Furthermore, six of 28 pairs of medications that had a significant correlation between proportion of

days covered (Table 4.8), suggesting some drug-to-drug variations in adherence behaviour.[68] To control for the potential influence of variations in dose changes and drug-to-drug adherence behaviours, an estimate of adherence rate was made using digoxin, spironolactone, amiodarone, and lipid-lowering agents ("Stable Dosed Drugs").

Table 4.7 Proportion of Days Covered* Statistics (n=114)

	n	Min	Max	% > 100%	Mean	St. Dev.
Diuretic	98	40%	200%	41.8%	102.2%	27.0%
ACE Inhibitor	94	44%	168%	45.7%	100.0%	20.6%
ARB	11	14%	172%	36.4%	100.7%	36.9%
Digoxin	66	33%	158%	37.9%	98.6%	20.1%
Beta-Blocker	89	39%	157%	42.7%	99.0%	19.1%
Spironolactone	53	31%	162%	49.1%	99.6%	26.0%
Amiodarone	18	41%	136%	27.8%	95.5%	21.5%
Lipid-Lowering Drug	56	53%	145%	33.9%	96.9%	16.0%
All Regularly Scheduled Drugs	121	34%	165%	47.1%	98.1%	16.0%
All Stable Dosed Drugs	103	47%	162%	38.8%	98.3%	17.1%

*Proportion of days covered = (number of days supplied ÷ 180 days) x 100%

Legend:
n = Number of subjects who received ≥ 1 dispensation during observation period
Min = Minimum proportion of days covered (lower numbers suggest poor adherence)
Max = Maximum proportion of days covered (100% suggests perfect coverage during observation period)
% > 100% = Proportion of subjects with more than 100% of days covered
Mean = Mean proportion of days covered for patients dispensed the medication
St. Dev. = Standard deviation of proportion of days covered
ACE Inhibitor = Angiotensin converting enzyme inhibitor
ARB = Angiontensin receptor blocker

Table 4.8 Correlation Matrix for Concurrent Medications

	ACEi	ARB	Digoxin	β-Blckr	Spiron	Amio	LLD
Diuretic	-0.004	0.082	0.069	0.118	0.059	-0.312	-0.106
n	78	7	58	72	44	14	46
ACEi	1.0	1.0**	-0.037	0.505**	0.227	0.452	0.316*
n		2	56	67	44	15	41
ARB		1.0	-0.333	0.762*	0.547		0.700
n			7	8	6	1	4
Digoxin			1.0	0.026	-0.121	-0.834**	0.016
n				45	37	8	30
β-Blckr				1.0	0.239	0.471	-0.032
n					38	13	39
Spiron					1.0	0.346	0.117
n						9	25
Amio						1.0	0.949**
N							8

*p < 0.05
**p < 0.01

Legend:
ACEi = Angiotensin converting enzyme inhibitor
ARB = Angiotensin receptor blocker
β-Blckr = beta adrenergic receptor blocker
Spiron = Spironolactone
Amio = Amiodarone
LLD = Lipid lowering drug
n = Number of patients who received ≥ 1 dispensation for both medications during observation period

4.3.3 Reliability Tests

4.3.3.1 Internal Consistency

The internal consistency reliability was assessed using Cronbach's alpha scores. The coefficient alpha for the self-reported adherence scale was 0.41. The measure of internal consistency for the 31-item Barriers scale was relatively high at 0.81. Table 4.9 displays the alpha coefficient for each domain in the Barriers scale. The domain with the highest alpha coefficient was patient knowledge at 0.74 and the lowest was social support at 0.38.

Table 4.9 Reliability Scores for Subscales of the Barriers to Medication Use Scale

	Number of Items (Total=31)	Alpha (n=114)	Intraclass Correlation Coefficient (n=39)
Patient Knowledge	5	0.7386	0.6304
Previous Experience	10	0.5537	0.4695
Social Support	8	0.3786	0.5812
Communication	4	0.6159	0.4660
Relationship with HCP	4	0.5405	-0.0107

As shown in Table 4.10, item-scale correlations ranged from –0.07 to 0.52, with 10 items below 0.3. During initial development of a new scale, a minimum criterion for inclusion is 0.3.[72,167] Removing the 10 items highlighted in Table 4.10 improved the coefficient alpha to 0.83 for the overall scale. Given this slight improvement, a summary score with the remaining 21 items was used along with the summary score for all 31 items for testing the construct hypotheses.

Table 4.10 Individual Item Properties within the Barriers to Medication Use Scale

Item	Corrected Item-Scale Correlation	Alpha if Item Deleted
Patient Knowledge:		
I know exactly why I am taking each one of my medications.*	0.5252	0.8004
Before starting a new medication, I know all the good things it will do for me.*	0.4928	0.7999
I am fully aware of all the bad (or "side") effects that may happen from my medications.*	0.3540	0.8048
I am always given instructions for how to take my medications.*	0.4874	0.8022
I am never told about drug interactions.	0.3914	0.8031
Previous Experience:		
The bad (or "side") effects of my medications prevent me from taking them as prescribed.	0.4927	0.7998
I could not afford my medications without a health plan.	0.1264	0.8147
I always make sacrifices to afford my medications.	0.3287	0.8062
The times for taking my medications are inconvenient.	0.4448	0.8016
My medications always make me too tired to do anything.	0.4371	0.8017
I never feel any benefit from my medications.	0.2457	0.8099
A medication organizer helps to remind me about taking my medications.*	0.0126	0.8214
The effect of my water pill makes it very difficult to plan my day.	0.3931	0.8031
How often do you change the dose of your water pill to fit your daily plans?†	0.2308	0.8093
How often do you change the time that you take your water pill to fit your daily plans?†	0.1776	0.8111
Social Support:		
I think that my condition is a burden to my family.	0.3599	0.8047
My congestive heart failure prevents me from doing the things that I like to do.	0.1953	08112
I have a positive view for approaching each day.*	0.3539	0.8056
I always get advice from my family and friends that goes against my healthcare provider's advice.	0.4240	0.8024
My family is always interested in learning more about my condition.*	0.3264	0.8062
My family never helps me take my medication.	0.1804	0.8137
If I get into trouble with my condition, my family knows exactly what to do to help me.*	0.3520	0.8050
If I knew about others with congestive heart failure, I would talk to them to see if they have similar concerns.*	-0.0694	0.8205
Communication:		
I always ask questions when I do not understand something about my medications.*	0.3446	0.8058
I never know what to ask about my medications.	0.4632	0.8011
I always understand the answers to my questions.*	0.4088	0.8034
How often is medical information explained in a way that you can understand?*†	0.5224	0.8005
Relationship with Healthcare Professional:		
These people have adequate knowledge to answer my questions.*	0.3846	0.8054
These people do not seem interested in what I have to say about my condition.	0.4141	0.8023
I am afraid to tell these people that I have missed taking some medications.	0.2694	0.8080
I trust these people.*	0.1600	0.8114

Legend:
* Reverse-scored items.
Response Options: 1, strongly disagree; 2, disagree; 3, neutral; 4, agree; 5, strongly agree
† Response Options: 1, none of the time; 2, a little of the time; 3, some of the time; 4, most of the time; 5, all of the time

4.3.3.2 Test-Retest Reliability

Stability of responses to the self-reported adherence scale and the Barriers scale was assessed by administering the same set of questions to the same subjects at two different times over a short interval. The second questionnaire was mailed to consecutive respondents approximately one week after receipt of the first questionnaire. The average interval between receipt of both surveys was 19 days (range 12 to 93 days). The intraclass correlation coefficient (ICC) was used to assess test-retest reliability.[153] The ICC for the self-reported medication use scale was 0.63 (95% CI 0.40 to 0.79). The ICC for the Barriers scale was 0.59 (95% CI 0.34 to 0.76). Four of the five domains within the Barriers scale were reasonably stable with an ICC exceeding 0.45 (Table 4.9).

4.3.4 Construct Validity Tests

Construct validity was assessed through a series of hypotheses that were tested by correlation analyses. Although pharmacies were contacted for all 114 patients who returned the first survey, there were insufficient data for one patient to estimate an adherence rate. Therefore, for each correlation, there are 113 matched sets.

4.3.4.1 Perceived Barriers versus Proportion of Days Covered

The correlation coefficient between perceived barriers and proportion of days covered was –0.13; however, this relationship was not statistically significant ($p=0.158$). Although the association was poor ($r < 0.2$), it was in the hypothesized direction; i.e., that patients in this sample had a high level of adherence and reported few barriers to medication use.

There was very little change in the estimate of correlation when the reduced, 21-item Barriers scale was used (Table 4.11). Evaluation of the association between the five domains within the Barriers scale and the proportion of days covered revealed that although none of the correlation coefficients reached statistical significance, four of the five were in the hypothesized direction.

Table 4.11 Associations Between Barriers Scale and Proportion of Days Covered

	Pearson Correlation	p
31-item Scale	-0.134	0.158
21-item Scale	-0.128	0.177
Domain Scores		
Patient Knowledge	0.004	0.965
Previous Experience	-0.128	0.178
Social Support	-0.116	0.219
Communication	-0.042	0.659
Relationship	-0.183	0.053

4.3.4.2 Health-Related Quality of Life versus Proportion of Days Covered

The relationship between the patient's reported quality of life, assessed by the MLwHF scale, and proportion of days covered was statistically significantly correlated ($p=0.028$). The correlation coefficient was 0.21, suggesting a low association ($0.2 \leq r < 0.4$) between these two variables. This association was in the hypothesized direction in that patients with a high level of adherence would perceive a better quality of life than patients with poor adherence.

4.3.4.3 Health-Related Quality of Life versus Perceived Barriers

The relationship between the patient's reported quality of life, assessed by the MLwHF scale, and perceived barriers was statistically significantly correlated ($p<0.001$). The correlation coefficient was –0.39, suggesting a low association ($0.2 \leq r < 0.4$)

between these two variables. This association was in the hypothesized direction, in that patients who perceived a high quality of life would perceive few barriers to medication use, and conversely those who perceived a poor quality of life would have a high level of perceived barriers.

Using the 21-item scale score, the association with the MLwHF scale decreased slightly (Table 4.12). Evaluation of the association between the five domains within the Barriers scale and the MLwHF scale revealed that three of the correlations were statistically significant. The correlation between social support and the MLwHF scale was the highest with a Pearson product moment correlation coefficient of -0.47, suggesting a moderate ($0.4 \leq r < 0.7$) association between these two variables.

Table 4.12
Associations between barriers scale and Minnesota Living with Heart Failure Scale

	Pearson Correlation	P
31-item Scale	-0.387	< 0.001
21-item Scale	-0.349	< 0.001
Domain Scores		
Patient Knowledge	-0.154	0.101
Previous Experience	-0.336	< 0.001
Social Support	-0.469	< 0.001
Communication	-0.125	0.188
Relationship	-0.196	0.036

4.3.4.4 Self-Reported Medication Use Behaviour versus Proportion of Days Covered

The relationship between the patient's reported medication use and the adherence rate estimated by proportion of days covered was not statistically significantly correlated ($p=0.352$). The correlation coefficient was –0.09, suggesting a poor association ($r < 0.2$). The association was in the hypothesized direction, in that patients who reported good

adherence (indicated by a low score) would have a high proportion of days covered, and conversely patients reporting poor adherence (indicated by a high score) would have a low proportion of days covered.

4.3.4.5 Prediction of Good Adherence with Self-Reported Medication Use Behaviour

Twelve patients in the study sample had a proportion of days covered less than 80%. The ability of the self-reported scale to identify patients who were adherent (proportion of days covered ≥ 80%) was estimated using two methods. Using the 'high' and 'low' categories established by Morisky et al.[74], the predictive value when positive was 0.93, however this method could not accurately predict poor adherence.

4.3.4.6 Summary of Tests of Construct Validity

A summary of the hypothesized and observed correlations between the variables is presented in Table 4.13.

Table 4.13 Hypothesized and Observed Correlations

	Proportion of Days Covered	Minnesota Living with Heart Failure	Self-Reported Adherence
Barriers Score	Expected: - -	Expected: -	Not tested
	Observed: -	Observed: -	
Proportion of Days Covered		Expected: +	Expected: - -
		Observed: +	Observed: -

Legend:

+ = Weak positive correlation
++ = Moderate positive correlation
+++ = Strong positive correlation

\- = Weak negative correlation
\- - = Moderate negative correlation
\- - - = Strong negative correlation

Chapter 5

Discussion

5.1.0 Summary and Discussion of Results

Congestive heart failure (CHF) is a complex syndrome that produces severe functional limitations and a high rate of hospitalization and mortality. New information continually provides greater insight into the pathophysiology of this disease, which in turn leads to new therapeutic options. Management can become quite complex, as patients are required to take medications for both symptom control and to prevent disease progression (i.e., prevention). Current medication regimens may include a combination of angiotensin converting enzyme inhibitor, beta-blockers, sprionolactone, digoxin, and diuretics. The patient's role in management of CHF is increasing as they become more involved in therapeutic decisions.

Faced with the changing landscape in CHF management, it is important for clinicians to identify impediments that may prevent patients from implementing and maintaining optimal drug therapy. Furthermore, clinicians must identify patients who may be at risk of poor adherence in order to provide effective and efficient interventions to improve adherence rates. The purpose of this project was to develop and provide initial psychometric data for a new instrument designed to identify patient-perceived barriers to medication use.

A standard instrument development process, well established in health-related quality of life scale development, was utilized.[140] Items for the instrument were produced through a review of the literature, discussions with clinicians familiar with CHF, and focus groups involving people with CHF. Five domains of potential barriers were

identified and included in the instrument: 1) patient knowledge, 2) previous medication experiences, 3) social support, 4) ease of communication and 5) relationships with healthcare professionals. Questions were formatted with two types of item stems and corresponding five-point response options. Initial information on the measurement properties, reliability and validity, of the instrument were evaluated by administering it to a group of patients attending the Heart Function Clinic at the University of Alberta.

Patients with CHF played an integral role in the development of this instrument. This collaboration was established based on the belief that an understanding of the patient's own concept and terminology were paramount in the development of an instrument measuring patient-perceived barriers to medication use.[39,40] This perspective is consistent with comments on the desired characteristics of health-related quality of life instruments.[168] As the perception of barriers to medication use are unique personal qualities, instruments developed to identify these barriers must be developed from the opinions of patients themselves.[168]

5.1.1 Instrument Development and Focus Groups

During the item generation phase of instrument development, focus groups provided an efficient method for exploring patient opinions regarding medication use. This form of group interview created an opportunity for participants to interact and share in their experiences with taking medications for CHF. The focus groups were held over a brief period of time allowing for rapid development of the questionnaire during the early stages of this project. Other methods of item generation, such as mail or telephone surveys, are time consuming and rely on the subjects' ability to articulate exactly how

they feel about an issue in isolation. Within the focus group sessions, participants heard what others had to say, which may have helped them articulate their own viewpoints.[141,142] With this group interaction, it was possible to develop a richer understanding of the issues that patients consider when taking medications for CHF. Furthermore, the terms used by participants to refer to their medications and to CHF were used in development of the instrument questions.

One other advantage of focus groups was the high degree of content validity.[146,147] Participants tended to concentrate on the major issues of a given area, with the amount of time spent on discussion roughly proportional to importance.[147] This is advantageous for generating and selecting items for a new survey.[140] Factors that could be perceived as barriers to optimal medication use were grouped into five categories. Participants in the focus group sessions identified that comfort in their level of knowledge about CHF and its treatment, previous experiences with medications, support from family and friends, clear communication, and relationships with healthcare professionals were key elements influencing their use of medications.[32]

Participants identified knowledge as a key tool for helping them follow therapeutic recommendations and manage CHF. A lack of understanding why and how to take a medication was considered to be a barrier to optimal use of medication. For example, some participants noted their ability to recognize the shape and color of the pills they take, yet did not know what the medication was for or how to take it. Without knowing the purpose of the medication and the goals of therapy, participants felt they would be less inclined to continue taking it. Information on drug interactions, appropriate scheduling for dosages and duration of therapy are also necessary to

encourage optimal use of medications. This observation is consistent with initiatives that have demonstrated improved medication use after educational interventions.[120]

Prior experience with medications can shape future activity with the medications. Findings from the focus group data supported a previous observation by others that patients will change the use of diuretics because of their effect on social activities.[31] These findings are consistent with the theory of intelligent noncompliance.[110] Patients may alter their use of medications to avoid undesired effects, to test the presence of a disease or to avoid the stigma of taking medications in public.[110,111] Over years of therapy, patients learn how their body reacts to medications. They may then alter the use of medications to avoid adverse outcomes, or to enjoy desired activities. This control over the disease and its therapy has been suggested to contribute to better adherence.[111]

Support from both family and friends was important for following advice and taking medications. Findings from the focus groups are similar to other authors in that a network of support is helpful in maintaining good adherence.[169] One consistent finding of note was that all participants stated a need to interact with others to share their experiences and learn that they were not alone. Participants also identified their spouses and close family members as valuable resources. These people were relied upon for assistance with medications and turned to in times of need such as an exacerbation of CHF symptoms. These factors all contribute to a positive attitude towards illness, which can have a positive impact on adherence.[134]

Findings from the focus groups regarding relationships with healthcare professionals are also consistent with previous literature. Participants stressed that a trusting relationship with their healthcare professionals was essential because they were

less inclined to follow advice of caregivers that they did not trust. As others have found, patient trust is a major influencing factor for adherence and continued attendance at clinics.[31,87,132] These focus groups also revealed that the language healthcare professionals use to communicate information is considered very important. Put simply, a patient is less likely to follow instructions he or she is unable to understand.[48] For example, vital information regarding a change in angiotensin converting enzyme inhibitor dose may be lost in the technical jargon of renal function and therapeutic targets.

Finally, the focus groups contributed to assessment of face validity of the new instrument. One task of the fourth focus group was to complete an interim draft of the survey and provide feedback on overall appearance and organization. During the initial stages of instrument development, focus groups wee useful for these purposes.[140,146]

5.1.2 Instrument Testing

5.1.2.1 Study Sample

The testing phase of this project involved 114 participants. A high proportion (88%) of patients approached for this phase completed and returned the survey. This response rate may be indicative of the rapport clinicians have with patients attending the Heart Function Clinic at the University of Alberta and illustrates that these patients have a high degree of interest in management of their CHF. During recruitment, several subjects stated they had a desire to participate in projects that they felt would improve care. Given this high level of interest in the patients who comprised the sampling frame, a lower response rate would have cast suspicion on the quality of responses. For example, it may have been that only those with few perceived barriers would have

responded, or that respondents may not have been entirely candid with their answers. A comparison of the demographic data for the 14 non-responders revealed that they were similar in age and disease severity to the 114 respondents.

Participants in the testing phase had similar characteristics to those in the Heart Function Clinic population.[166] The majority of patients were mildly symptomatic with the appearance of symptoms on exertion (NYHA class II). In general, patients felt they were relatively healthy and less than one third were hospitalized in the past year. Given these similarities, the results could be generalized to CHF patients attending an ambulatory care clinic. However, the majority of patients attending this specialty clinic do not break appointments and also stated their interest in participating in projects to further improve management of their CHF. This suggests that patients in the sampling frame are highly motivated and therefore the results may not be generalized to all patients with CHF.

5.1.2.2 Assessment of Reliability

Reliability of an instrument refers to the consistency of the score, or the extent to which the score is free of random error.[72] Adequate reliability is an essential precursor to evaluation of validity. In this study internal consistency and test-retest reliability were assessed.

Internal consistency reliability of the new instrument was assessed using the coefficient alpha.[150] For early stages of instrument testing, a modest level of reliability is considered sufficient, such as reliabilities of 0.7 or higher.[72,152] The estimate of reliability is dependent on two factors: the amount of inter-item covariance within the scale and the number of items.[72,152]

The alpha coefficient for the 31-item barriers scale was 0.81, suggesting good internal consistency reliability. However, when the items were grouped according to the five themes identified in the focus groups, alpha scores decreased. Four of the five subscales had alpha scores below 0.7. This reduced performance could have been due in part to the reduction in number of items. Another contributing factor could have been the nature of the study sample. All participants in the testing phase had a high rate of adherence and reported few barriers to medication use. In samples that have low variance, the reliability coefficient will be lower because it is a function of the differences between individuals.[152,170]

A second measure of internal consistency is to compare each item to the scale it is theoretically associated with. Item to total correlations are considered acceptable in new instruments when they are above 0.3.[72,167] Any item that does not meet this criterion should be considered for exclusion from the scale. In this study, 10 of the 31 items had item to total correlation coefficients below 0.3. Removal of these 10 scores did improve the overall coefficient alpha slightly to 0.83, suggesting there may have been redundancies within the barriers scale. With this modest improvement, a summary score using the remaining 21 items was also used to test the original hypotheses. However, correlation coefficients decreased slightly in all comparisons, suggesting a weaker association with the smaller scale.

Responses to the Barriers scale appeared to be relatively stable over time. As would be expected with the smaller number of items, test-retest correlation for the five barrier subscales were lower than for the overall 31-item scale. In comparison to other instruments, stability of the barriers scale appeared to be poor.[132,157,158] However, the low

intraclass correlation coefficient (ICC) observed in this study may have been due, again, to low variability in the sample as discussed previously. The ICC compares variance amongst patients to overall variance of the scale and to variance due to change over time.[153] The low variance within the sample may have lowered the ICC estimate. Further evaluation of scale reliability in other patient samples will be required.

5.1.2.3 Assessment of Validity

Evaluation of content validity is a subjective process. To ensure the Barriers survey contained all relevant issues of patient-perceived barriers to medication use, several resources were used. Articles describing medication adherence behaviour and predictors of medication use were reviewed for pertinent information. Clinicians who manage patients with CHF were asked for their opinions regarding medication use in these patients. This background work led to discussions with the most important resource for development of this instrument – the patient with CHF.[39,40] As discussed previously, focus group methodology is very useful in the initial stages of instrument development because of the high degree of content validity.[140,146,147] Therefore focus groups were used to interview several patients with CHF. As a final step, survey respondents were asked if they felt that the survey had missed any essential topics.

Clinicians and participants of the final focus group contributed to assessment of face validity. The flow of questions, spacing, and use of 'white space' was felt to be acceptable. Although the survey was eight pages in length, the high response rate and 25 minutes required to complete it suggest that the survey does not have a high degree of respondent burden.

Construct validity of the Barriers scale was assessed using correlation analyses. For each hypothesis involving the Barriers scale, correlation coefficients were calculated with the 31-item scale and each of the five subscales. A correlation estimate was also calculated for the reduced 21-item scale. With the low degree of variability amongst patients in the sample, many of the results were not statistically significant. However, in each analysis the direction of the association was considered to be the most important factor in this initial evaluation.

Primary Hypothesis

The primary hypothesis for this study was that adherence rate would have a negative correlation with perceived barriers. This construct was developed from the Health Belief Model (HBM) in that patients will take a course of action (i.e., adhere to medications) if they believe that the benefits outweigh anticipated barriers.[30] The hypothesized direction of this association was based on the work of others who reported that patients who adhere to medications perceive few barriers and conversely, those with poor adherence perceive several barriers.[157,158] The relationship was evaluated using an adherence rate estimated from the proportion of days covered as well as self-reported adherence behaviour.

Each of the correlation estimates was in the hypothesized direction except for the relationship between patient knowledge and adherence rate, which had an extremely low correlation coefficient. Patients in this sample had a very high proportion of days covered, which corresponded to a low score on the Barriers scale. Low variance in the proportion of days covered, the self-reported adherence behaviour, and patient-perceived barriers would make evaluation of covariance difficult.[72]

Although the correlation estimates between adherence rate and perceived barriers failed to reach statistical significance, the direction of each association is consistent with findings of others. In an assessment of the relationship between barriers and adherence to diabetes regimens, Glasgow et al. found a similar inverse relationship between the frequency of reported barriers and self-reported measures of adherence.[157] In another study of patients with diabetes, Jones et al. dichotomized patients reporting adherence rates above and below 50%.[171] Those with higher adherence rates had significantly higher barrier scores than those with low adherence rates.[171]

The intent of the Barriers scale is to detect barriers to medication use in patients who are having difficulty with adherence. This initial phase of instrument testing has demonstrated that the relationship between adherence rate and patient-perceived barriers is in the hypothesized direction and consistent with the findings of others. It would be useful to continue testing the instrument in other patient groups.

Secondary Hypotheses

Two secondary hypotheses were tested based on hypothetical constructs developed from the Health Belief Model.[28,29] This model established a framework for understanding the relationship between patient-perceived barriers to medication use and observed medication use behaviour.

The first relationship was between perceived barriers and health related quality of life. This relationship was explored based on the hypothetical construct that patients who believe the threat of a condition is high will perceive more barriers. According to the HBM, threat of a condition is influenced by the patient's perception of disease severity and their susceptibility to it.[30] The Minnesota Living with Heart Failure (MLwHF) scale

was used as a measure of the patient's perceived susceptibility to and severity of CHF.[30,163] An assumption was made that those who reported a good health related quality of life would perceive that CHF was less threatening.[29] Therefore, the relationship between health related quality of life and perceived barriers would have a negative correlation.

A low, but statistically significant negative correlation was observed between scores from the Barriers scale and the MLwHF scale. The social support component of the Barriers scale had the highest correlation with the MLwHF score. These findings are consistent with the hypothesized construct, suggesting that patients with a good quality of life would perceive few barriers to medication use. Furthermore, it appears that the strength of their social network influences the patients' perception of health related quality of life. These associations require evaluation in future applications of the Barriers survey.

The second relationship explored was between the patient's health related quality of life and medication use. This relationship was based on the hypothetical construct that a patient will take a course of action (i.e., adhere to medications) if they believe that a condition has serious consequences and that they are susceptible to it.[30] It appears that patients who adhere to medications are at lower risk for adverse clinical outcomes (and therefore may have a better health related quality of life).[16,61] The relationship between health related quality of life was hypothesized to have a weak, but positive correlation with adherence rate.

In this study, the relationship had a low, but statistically significant positive correlation. This association is consistent with the findings of others in that refill

compliance was associated with clinical outcomes.[16,61] Numerous authors have suggested a link between poor adherence and worsening CHF symptoms and hospitalizations.[21-26] This relationship between patient-reported health-related quality of life and adherence rate requires further investigation. The findings of this study lead to other hypotheses such as:

(a) Would an increase in adherence rate be associated with an improvement in health-related quality of life?

(b) Are patients who perceive a good quality of life more adherent to medication regimens?

5.1.3 Evaluation of the Self-Reported Medication Use Behaviour Scale

Internal consistency of the self-reported adherence scale was evaluated in a fashion similar to the Barriers scale. As with the Barriers scale, the coefficient alpha was quite low. The most likely reason for this low value was the small degree of variability within the sample. Using a five-point response scale, the average score was 13.4 (±11.8), with 22 patients (20%) reporting excellent adherence (score = 0). Few differences between individuals in this sample would lower the reliability estimate.[152,170] Reliability of the same four questions using a dichotomous response option has been reported to be better in other patient groups.[74,172] Collapsing the scale used in this study back to the dichotomous option actually decreased the coefficient alpha. Comparison between this study and the two previous studies was not possible because variance was not reported in the previous studies.[74,172]

Expanding the response options to a five-point scale was hypothesized to improve the discriminatory ability of the self-reported adherence scale. However, the five-point response option did not perform as well in this sample as the original dichotomous response option has in other studies.[74,172] Adjustment back to the original dichotomous responses actually worsened performance of the scale in this study. The low degree of variability within the sample may have affected the reliability estimate. Therefore the data are inconclusive on the superiority of the five-point response scale versus dichotomous response options.

The relationship between the two measures of adherence rate was examined with the expectation that the self-reported medication use behaviour scale would have a positive correlation with adherence rate estimated from the proportion of days covered. Although the correlation estimate was in the hypothesized direction, it did not reach statistical significance. Patients in the sample had a high level of adherence, with the majority having more than 100% of their days covered. The low degree of variance within both measures also made it difficult to evaluate covariance.[72]

A second assessment of the relationship between the self-reported scale and proportion of days covered evaluated predictive ability of the self-reported scale. This assessment was confounded by the low percentage of patients with a low adherence rate. All but 12 patients (11%) had adherence rates above 80%. With this small number, it was not possible to evaluate predictive ability of the self-reported scale. Other authors have demonstrated the predictive ability of the self-reported scale using a dichotomous response option.[74,172] The predictive ability of the five-point response option requires further evaluation.

5.2.0 Study Limitations

Significant differences between study subjects and the population of interest could limit the extent to which these findings can be applied to the general population of patients with CHF. Characteristics of participants in both phases of the study appeared to be similar to other patients in the Heart Function Clinic, University of Alberta.[166] This suggests that the study sample is representative of patients in a specialty clinic. However, patients attending a specialty clinic may be sicker or have more complex disease than patients in the general population.[6,166] Heart failure clinics use a multidisciplinary approach to optimize management of patients with CHF.[173,174] Services provided in a specialty clinic may lead to a patient who is more informed about CHF and who may be more motivated to participate in their care.[166,175] As subjects were drawn from the Heart Function Clinic, University of Alberta, results of this study may not be representative of all CHF patients.

Research subjects in both the instrument development stage and testing stage volunteered to participate. Volunteering for a study of adherence behaviour may confound the observations because volunteers may have different characteristics than non-volunteers. A review of the literature suggests that volunteers tend to be better educated, more sociable and curious, and have a higher need for social approval.[176] These traits have been loosely associated with better adherence behaviour[15,124,125], suggesting that non-volunteers may also be less adherent to medications. This volunteer bias may be especially difficult to overcome in adherence studies, as those who are of most interest to the researcher may not consent to participate. Researchers should be sensitive to this bias and attempt to make the project as non-threatening as possible,

perhaps even making it part of the usual care in a clinic.[176] Recruitment may also be improved if the person making the request is someone the subject considers credible, such as another patient, someone well known to the target population, or someone in a leadership role.[176]

Measurement of a complex trait such as medication use behaviour is not without uncertainty, especially during the initial stages of instrument development. Testing constructs to ensure that the instrument measures the intended traits relies on an understanding of the relationship between an observed behaviour and the factors that influence that behaviour.[143] In this study the Health Belief Model established a framework to explore the interaction between perceived barriers and medication use. Some authors suggest that health-related behaviours are complex mixtures of five personality domains, requiring a more comprehensive structural theory of personality.[177,178] Using the Health Belief Model in this initial stage of testing the Barriers scale may have limited the evaluation. Perhaps a broader perspective is required when exploring a patient's attitudes and beliefs towards medication use. People with chronic illness must cope with numerous changes to their lifestyle, including the addition of medication therapy. Successful adherence to these changes requires skills such as adaptation and coping mechanisms.[178,179] Inclusion of personality variables such as conscientiousness and coping ability should be included in future evaluations.[178,180]

The recruitment method for the focus group sessions may have limited findings from this stage of instrument development because all patients volunteered to participate. Patients who agree to participate in the focus groups may have been willing to participate because they felt confident in their knowledge and management of CHF.[176] This process

may have selected patients with few perceived barriers to medication use, resulting in a biased group of items generated for the instrument. However, an open question requesting suggestions for missed elements of medication use did not produce any new information. Furthermore, focus groups were held with patients from both an ambulatory specialty clinic and a general family medicine clinic. Data from both groups were very similar and after four sessions, it was felt that saturation had been achieved.

A major limitation of the testing phase of this study was the low degree of variability amongst respondents. Respondents were grouped at one end of the 0-100 range for the Barriers scale and the self-reported adherence scale. The majority of patients filled sufficient quantities of medications to have 98% or more days covered. This affected correlation analyses because the small degree of covariance may have caused some relationships to be non-significant. Additional work is required, especially to evaluate the instrument in patient groups with diverse adherence rates.

Ability of pharmacy refill data to estimate adherence is dependent on the accuracy and completeness of the records.[38,70,81] First, the estimate can be confounded when the patient uses medications obtained from outside of the database.[61] In this study, survey respondents were asked to list all the pharmacies they obtain medications from and whether or not they received physician samples during the observation period. Furthermore, pharmacists were asked if they knew whether or not the survey respondents obtained medications from other pharmacies, or if copies of the prescriptions were requested from other pharmacies. A second source of confounding in this study was the frequent dosage changes during the observation period. It was difficult to estimate days supply when the number of tablets could be doubled or halved to bridge the current

supply into a supply of tablets with the new dosage. This phenomenon was observed frequently in the sample with angiotensin converting enzyme inhibitors and beta-blockers. Removal of refill data for these agents from the adherence estimate did not improve the correlation estimates, though. A third factor influencing adherence rate estimates was that patients were obtaining refills prior to depletion of their current supply, an observation in opposition to that of Steiner et al. who concluded that patients typically obtain less medication than prescribed.[61] As Grymonpre et al. and Christensen et al. observe, obtaining supplies before the previous supply is completed will contribute to an overestimated adherence rate.[70,81] The six-month observation period may have reduced the influence of early refills, however longer observation periods may reduce this even further.[81] Lastly, refill frequency is an indirect measure of adherence because it provides information on medication acquisition and does not provide information on medication consumption.[56,70] Despite these limitations, many authors advocate its use for estimating adherence rates in database research.[61,70,71]

One of the major criticisms of patient self-report is reliability of the responses.[42,69] Accuracy can be improved through the use of non-judgmental questions, posed in an environment that places the patient at ease.[73,181] This study used a modified version of a four-item self-reported instrument initially developed and tested in patients with hypertension.[74] Although this instrument appears to work well when a dichotomous response option is used[74,172], the ability of the instrument may not be optimised.[143] The scale performed better in this study when it was scored using the five-point response options instead of the dichotomous response options. However, further work is required to determine if this modification does improve discriminative ability.

5.3.0 Future Directions

5.3.1 Reevaluation of Questions in the Barriers Scale

Consideration was given to removal of the 10 items that scored poorly in the item to scale analysis. Hernandez suggests leaving low scoring items in a scale if they are theoretically and clinically important to the topic being surveyed and/or removal of these items have only a small impact on internal consistency.[158] It was decided to retain the 10 items for future tests for two reasons. First, the items provide relevant clinical information that is not obtained through other items. For example, one item asks for the patient's opinion regarding medication organizers (e.g., Dosett®). This information was considered to be important for understanding how respondents may organize their daily medication use and therefore guide future interventions. Second, although removal of the items did improve internal consistency, overall performance of the scale did not improve. In fact, estimates worsened when the reduced 21-item scale was used for calculating the correlation coefficient. Therefore, it appears that there is insufficient evidence to support removal of the 10 items at this stage of the Barriers scale development.

Instead of removing the 10 items, each question was reviewed for clarity. Upon careful examination, three items required reworking. The word "afford" in item 7 could be interpreted several ways, which may have contributed to ambiguous responses. The essence of this item was to explore the respondent's reliance on a health plan to offset the high cost of their medications. Item 12 appeared to be vague in reference to the need for a system to remember if medications were taken. Item 20 suggested two components: knowledge of others with CHF and willingness to talk. This "double-barreled" question

would make interpretation difficult. Modifications to these three items should be used in future iterations of this questionnaire.

Future evaluations of this instrument should involve further refining of the questions. Of particular interest will be performance of the 10 items identified in this study. If these items continue to perform poorly, they should be removed. Elimination of redundant items would provide a shorter measure with less respondent burden.

5.3.2 Testing in Other Patient Groups

With minor adjustments to the three items discussed above, the next logical step for the continued testing and application of the Barriers scale is to evaluate its performance in other patient groups. Ideally, the next sample should contain subjects with a range of adherence rates. This initial evaluation was done in a group of patients whose scores clustered at one end of the scales. Inclusion of subjects who would score throughout the range of possible scores would provide more variability and therefore a better assessment of the instrument.

Identification of patients with poor adherence and a high degree of barriers will be difficult. By nature, a patient with poor adherence to medications may be non-adherent to other initiatives, including a survey. In order to include these patients, innovative recruitment strategies will be required. One possibility is to ask community pharmacists to distribute the instrument to all patients requesting prescriptions for target medications. Although the intent of this strategy is to capture patients while they are waiting for their medications (making it easier to complete and return the survey), these patients are getting refills and therefore, but definition, may be adhering to their medications.

Another possibility is to contact patients who were recently discharged after treatment for exacerbation of CHF symptoms. Poor adherence to treatment recommendations is commonly associated with treatment failure and hospitalization for CHF.[21-24,26] Therefore targeting patients in hospital or recently discharged for CHF could potentially reach a higher proportion of patients with medication adherence difficulties.

5.3.3 Use of Other Quality of Life Scales

A new 23-item questionnaire recently demonstrated that it provides a better description of health related quality of life in patients with CHF than the existing MLwHF.[165] The Kansas City Cardiomyopathy Questionnaire (KCCQ) is more refined than the MLwHF in capturing information on symptoms, social limitations and patients' sense of self-efficacy.[165] Given the high correlation between social support barriers and the MLwHF, it would be interesting to evaluate the relationship between that barrier category and the KCCQ. Furthermore, the KCCQ appears to be more sensitive to clinical changes than the MLwHF.[165] This would be useful in future testing of the Barriers scale because changes in clinical status (e.g. a heightened sense of disease severity) may change a patient's perception of barriers to medication use.[30]

5.3.4 Assessment of Responsiveness

While the initial intention of this instrument was to discriminate between patients with good and poor adherence in order to identify barriers to medication use, the next step would be to evaluate its ability to respond to changes. This instrument could be

useful for not only detecting the presence of barriers, but also to demonstrate removal of the barrier after successful intervention.

5.4.0 Conclusions

This project resulted in the development of a new instrument to identify patient-perceived barriers to medication use. The instrument can be self-administered by the patient and requires approximately 20 minutes to complete. Responses and summary scores from the questionnaire could be used in a number of ways. For example, an overall barrier score, calculated by converting responses to all 31 items into a 0-100 scale, may able to identify patients with a high level of perceived barriers. Domain scores, calculated by converting responses to items within each domain into a score on a 0-100 scale, could be used to determine areas where individual patients may require specific interventions.

Initial evidence produced in the testing phase of this project suggests that the instrument has reasonable internal consistency reliability. Preliminary data also provides some evidence to support the principal construct that patients with good adherence will perceive a few of barriers to medication use. The ability of this instrument to discriminate between patients with high and low levels of perceived barriers (as well as good and poor levels of adherence) requires further exploration.

Instrument development is an ongoing, iterative process. As new information is developed, the instrument can be refined and tested in other patient groups. Over time, experience with the instrument will accumulate and its performance in various settings will be evaluated. The optimal result of this process would be acceptance and

incorporation of the Barriers scale into the daily practice of clinicians dealing with CHF patients.

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Appendix 1

Focus Group Recruitment Script

Hello _________________, this is ________ calling from the Heart Function Clinic.

I would like to invite you to a meeting we are having at the University Hospital on _______________, at 10 am.

We are going to have a group of people, much like you, meet together and discuss their experiences with medications.

We are inviting people from the Heart Function Clinic to come to this session, so you may recognize some of them.

Everybody at these sessions is taking medications for heart failure.

We want to gather opinions about the difficulties with taking medications. We also want to talk about the tools we use to help overcome these difficulties.
Your participation in this group is voluntary.

We will supply coffee, tea and muffins. We will also pay for your parking.

These meetings are part of a larger research project, so the funding for the food, drinks and parking comes from a research grant.

We will use the information from these sessions to develop and change materials we use to help people like you with their medications.

Appendix 2

Script for Opening Comments and Instructions to Participants

Welcome and Introductions

Consent to tape the meeting
As I indicated on the phone, your participation in this meeting is voluntary. I would like to tape this meeting and use the typed transcripts and notes to help me review the information gathered here today. Does everyone feel comfortable with this? Do I have your permission to tape the session?

Purpose for the meeting
You were asked to come here today to share your opinions and experiences with medications. All of you attend the heart function clinic and have the same condition called congestive heart failure. Some of you take exactly the same medications or combinations of medications.

Studies in people with high blood pressure, epilepsy, asthma or diabetes have shown that it is very difficult to take medications exactly as prescribed for a long time. In some studies, over half of the people will stop taking their medications after one year. As pharmacists and nurses, we are worried about this. We know that the medications used for heart failure can help people. But if people do not take these medications then they are not going to get the benefits. We would like your advice to find out what we can do to help people with their medications.

We are developing a new study to help people start on medications for congestive heart failure. One part of this study will be a program to help improve medication use. We want to develop a group of ideas that will help us help these people with their medications. There are several tools that we use already and I would like to gather your opinions on them.

There are two reasons why we are having these meetings. FIRST to find out about things that may prevent people from taking their medications. SECOND to gather your opinions about some of the tools we use to help people with their medications.

In this meeting, there are no right or wrong answers. Your honest opinion would be greatly appreciated. We would especially like to know if you find the tools useful or a waste of time, and what can be done to improve them. During this meeting, you may remember other people who may have different experiences. We would welcome you to share those experiences as well.

Before we get started, does anyone have any questions?

Appendix 3

Focus Group Question Map

Question 1 (icebreaker)
How has your life changed since you were diagnosed with congestive heart failure?
Probes:
- Lifestyle changes
- Now have to take medications

Question 2
What have you done to include taking medications into your daily routine?
Probes:
- Special considerations to medication regimens
- Lifestyle changes around medication times

Question 3
What are some difficulties you or anyone you know encountered when taking medications as they were prescribed?
Probes:
- Specific Barriers
    - known benefits of medication
    - experienced adverse effects in the past
    - cost of medications
    - remembering to take doses
    - relationship with healthcare professionals
- Tools or methods to overcome them

Appendix 4

Barrier Categories and Items

Category	Items	Theoretical Domain
Healthcare Professional	• Has adequate knowledge about heart failure to teach the patient and answer all his/her questions • Is genuinely concerned about the level of care the patient receives • The patient is concerned that a low level of adherence (either actual or perceived) may jeopardize his/her relationship with the healthcare professional	Patient confidence in HC pro Perceived attitude of HC pro Social desirability
Patient Knowledge	• Understand the disease process and its implications • Reason for taking a medication is fully understood • Expected beneficial effects are known • Tangible benefits (signs/symptoms) to be expected are known • Correct administration instructions known • Special considerations for specific medications (e.g. blood tests – purpose & expected (target) results; drug interactions – drug-drug, drug-food) • Expected adverse effects and a plan to deal with them (e.g. dry mouth, sedation)	Susceptibility
Previous Medication Experiences	• History of an actual or perceived adverse drug reaction • History of a tangible benefit produced after taking a medication • Expectation that the medication should improve symptoms so that the patient can return to activities he/she once enjoyed • Must make sacrifices in other areas to afford medications • Time to take medication interferes with a desired daily activity • Effect of a drug interferes with a desired daily activity (e.g. furosemide and meetings) • Not all medications taken at mealtime, bedtime or while brushing teeth (i.e. odd dose time – mid-afternoon) • A reminder device is used for dosage times	Confidence in medication “ “ Cost Convenience of treatment “ “ Perceived/actual severity of illness Social desirability Patients attitude Confidence in diagnosis and/or treatment

Category	Items	Theoretical Domain
Previous Medication Experiences – Continued	• Health status places an unacceptable limitation on daily activities • Health status places a burden on family/friends • Patients attitude to life (positive vs. negative) • Does the patient receive information from multiple sources that is conflicting or confusing (i.e. may dilute out important/useful information; reduce faith in healthcare professional's information)	
Patient Support	• Do family members help the patient learn more about his/her disease and medications • Do family members help the patient take or remember to take medications • Do family members know what to do if the disease worsens or symptoms become unbearable • Are there others with the same condition used as contacts and resources (e.g. a "buddy system" or support group)	
Communication	• Is the information received from healthcare professionals "user friendly" (i.e. useful; easy to understand) • If there is something the patient does not understand or does not know, does he/she ask questions	
Specific Drug Questions	• Change the time, dose or frequency of furosemide to fit daily plans • Alter daily plans to fit with effect of medication	

Appendix 5

Cover Letter and Barriers to Medication Use Survey

UNIVERSITY OF ALBERTA

date

«Title». «FirstName» «LastName»
«Address1»
«City», Alberta «PostalCode»

Dear «Title». «LastName»,

A short time ago, someone from the Heart Function Clinic telephoned you about a survey we are conducting. We are testing a new survey on medication use and were wondering if you would be interested in participating. Enclosed is a copy of the survey, a consent form from the University of Alberta, and a self-addressed, stamped envelope.

If you are interested in participating in this project, please read the consent form and sign it. If you have any questions, please call me at: 492-3793.

I would certainly appreciate it if you could take the time to complete this short survey, it should take you about 20 minutes to complete it. Once you are done, write the name of your pharmacy on the front page of the survey and return it along with the consent form to me in the stamped, self-addressed envelope. That is all that we require from you.

Thank you very much for your interest and participation!

Sincerely,

Scot H. Simpson, Pharm.D., M.Sc. (candidate)

Division of Cardiology
Department of Medicine

2C2 Walter Mackenzie Health Sciences Centre • 8440 - 112 Street • Edmonton • Alberta • Canada • T6G 2B7
Telephone (780) 407-8078 • Fax (780) 407-6452 • http://cardiosrvl.uah.ualberta.ca/

Factors Affecting Medication Use Questionnaire

Study Number: | | | |

This questionnaire asks you about your medications and how you use them.

Part I asks questions to provide us with important information about yourself.

Part II will ask for information about how you use your medications.

Part III will ask questions about how you are feeling.

Part IV asks questions about things that may influence how you use your medications.

Please circle the answer that best describes your opinion. There are no right or wrong answers. If you are unsure about how to answer, please give the best answer you can.

All information you provide is confidential. We would appreciate your honest opinion on each question.

If you have any questions about this questionnaire, please contact Dr. Scot Simpson at 492-3793

Please continue on the next page...

Part I – About Yourself

The following questions are used to gather general information. All personal information will be grouped together and **no individual information will be released.**

1. What year were you born? [ ][ ][ ][ ]

2. What is your sex? (circle one) ___ Male ___ Female

3. What is your marital status? (check one)
   ___ Single ___ Divorced
   ___ Widowed ___ Common-Law
   ___ Married ___ Other: (specify) ___________

4. In what year were you diagnosed with congestive heart failure? [ ][ ][ ][ ]
   [ ] Don't Know

5. **Education** (check one)
   ____ Less than High School
   ____ High School Graduate
   ____ Some College / University
   ____ College / University Graduate

6. **Total yearly household income before taxes** (check one)
   ____ Under $10,000
   ____ $10,000 - $29,999
   ____ $30,000 - $49,999
   ____ $50,000 and above

7. What are the first three digits of your postal code? [ ][ ][ ]

8. Race (check one)
   ____ First Nations
   ____ Oriental
   ____ East Indian / South Asian
   ____ Caucasian
   ____ Black
   ____ Others (please specify) ___________

9. How many different prescription medications do you take each day? _____

10. How many herbal, natural or vitamin products do you take on a daily basis? _____

11. How many non-prescription medications do you take (other than those listed above)? _____

	Excellent	Very Good	Good	Fair	Poor
12. In general, how would you rate your health **over the past 4 weeks**?	1	2	3	4	5

Please continue on the next page...

Part II – About Your Medications

The following questions are used to describe how you use your medications. Please read each question carefully, keeping in mind how you currently use your medications. On the line next to each statement circle the number for the opinion which is closest to your own view.

For example, if you strongly agree with the following statement, you would circle the number 5 indicated below:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Cats are smarter than dogs.	1	2	3	4	5

For questions that ask how often something happens, please use the following guide:

Never	< 1 time per month
Rarely	once per month
Sometimes	2-3 times per month
Often	1-3 times per week
Always	>5 times per week

Some questions will look similar to others, but each statement is different. You should answer each statement by itself. There are no right or wrong answers. Please circle only one number for each statement.

	Never	Rarely	Sometimes	Often	Always
1. Do you ever forget to take your medications?	1	2	3	4	5
2. Are you careless at times about taking your medications?	1	2	3	4	5
3. When you feel better, do you stop taking your medications?	1	2	3	4	5
4. If you feel worse when you take your medications, do you stop taking them?	1	2	3	4	5

Please continue on the next page...

Part III – About Your Health (Living with Heart Failure Questionnaire)

These questions concern how your heart failure (heart condition) has prevented you from living as you wanted during the last month. The items listed below describe different ways some people are affected. If you are sure an item does not apply to you or is not related to your heart failure then circle 0 (No) and go on to the next item. If an item does apply to you, then circle the number rating how much it prevented you from living as you wanted. Remember to think about **ONLY THE LAST MONTH**.

Did your heart failure prevent you from living as you wanted during the last month by:

	No	Very Little		→		Very Much
1. Causing swelling in your ankles, legs, etc.?	0	1	2	3	4	5
2. Making you sit or lie down to rest during the day?	0	1	2	3	4	5
3. Making your walking about or climbing stairs difficult?	0	1	2	3	4	5
4. Making your working around the house or yard difficult?	0	1	2	3	4	5
5. Making your going places away from home difficult?	0	1	2	3	4	5
6. Making your sleeping well at night difficult?	0	1	2	3	4	5
7. Making your relating to or doing things with your friends or family difficult?	0	1	2	3	4	5
8. Making your working to earn a living difficult?	0	1	2	3	4	5
9. Making your recreational pastimes, sports or hobbies difficult?	0	1	2	3	4	5
10. Making your sexual activities difficult?	0	1	2	3	4	5

Please continue on the next page...

Did your heart failure prevent you from living as you wanted during the last month by:

	No	Very Little		→		Very Much
11. Making you eat less of the foods you like?	0	1	2	3	4	5
12. Making you short of breath?	0	1	2	3	4	5
13. Making you tired, fatigued, or low on energy?	0	1	2	3	4	5
14. Making you stay in a hospital?	0	1	2	3	4	5
15. Costing you money for medical care?	0	1	2	3	4	5
16. Giving you side effects from medications?	0	1	2	3	4	5
17. Making you feel you are a burden to your family and friends?	0	1	2	3	4	5
18. Making you feel a loss of self-control in your life?	0	1	2	3	4	5
19. Making you worry?	0	1	2	3	4	5
20. Making it difficult for you to concentrate or remember things?	0	1	2	3	4	5
21. Making you feel depressed?	0	1	2	3	4	5

Please continue on the next page...

Part IV – About Your Use of Medications

The following questions ask about things that might affect how you use your medications. There are no right or wrong answers. All information you provide is confidential. Please circle the number that best describes your opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I know exactly why I am taking each one of my medications.	1	2	3	4	5
2. Before starting a new medication, I know all the good things it will do for me.	1	2	3	4	5
3. I am fully aware of all the bad (or "side") effects that may happen from my medications.	1	2	3	4	5
4. I am always given instructions for how to take my medications.	1	2	3	4	5
5. I am never told about drug interactions.	1	2	3	4	5
6. The bad (or "side") effects of my medications prevent me from taking them as prescribed.	1	2	3	4	5
7. I could not afford my medications without a health plan.	1	2	3	4	5
8. I always make sacrifices to afford my medications.	1	2	3	4	5
9. The times for taking my medications are inconvenient.	1	2	3	4	5
10. My medications always make me too tired to do anything.	1	2	3	4	5
11. I never feel any benefit from my medications.	1	2	3	4	5
12. A medication organizer helps to remind me about taking my medications.	1	2	3	4	5
13. I think that my condition is a burden to my family.	1	2	3	4	5

Please continue on the next page...

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
14. My congestive heart failure prevents me from doing the things that I like to do.	1	2	3	4	5
15. I have a positive view for approaching each day.	1	2	3	4	5
16. I always get advice from my family and friends that goes against my healthcare provider's advice.	1	2	3	4	5
17. My family is always interested in learning more about my condition.	1	2	3	4	5
18. My family never helps me take my medication.	1	2	3	4	5
19. If I get into trouble with my condition, my family knows exactly what to do to help me.	1	2	3	4	5
20. If I knew about others with congestive heart failure, I would talk to them to see if they have similar concerns.	1	2	3	4	5
21. I always ask questions when I do not understand something about my medications.	1	2	3	4	5
22. I never know what to ask about my medications.	1	2	3	4	5
23. I always understand the answers to my questions.	1	2	3	4	5
24. The effect of my water pill makes it very difficult to plan my day.	1	2	3	4	5

	None of the Time	A Little of the Time	Some of the Time	Most of the Time	All of the Time
25. How often is medical information explained in a way that you can understand?	1	2	3	4	5
26. How often do you change the dose of your water pill to fit your daily plans?	1	2	3	4	5
27. How often do you change the time of day that you take your water pill to fit your daily plans?	1	2	3	4	5

Please continue on the next page...

There are many members of the healthcare team to help you with your heart disease and give you information about medications. Some of these people are cardiologists, family doctors, nurses and pharmacists. Think about these people as you answer **questions 28 to 31.**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
28. These people have adequate knowledge to answer my questions.	1	2	3	4	5
29. These people do not seem interested in what I have to say about my condition.	1	2	3	4	5
30. I am afraid to tell these people that I have missed taking some medications.	1	2	3	4	5
31. I trust these people.	1	2	3	4	5

32. Are there any other things that influence how you take your medications that we have not covered?

____

____

Thank you for completing this questionnaire. We certainly appreciate your time to answer all the questions.

Please return the questionnaire and your consent from in the self addressed envelope that you received with the questionnaire. The mailing address is:

Dr. Scot H. Simpson
213 Heritage Medical Research Centre
University of Alberta
Edmonton, AB T6G 2S2

Appendix 6

Cover Letter and Abbreviated Barriers Survey for Retest

UNIVERSITY OF ALBERTA

date

«Title». «FirstName» «LastName»
«Address1»
«City», «Province» «PostalCode»

Dear «Title». «LastName»,

About 2 weeks ago you completed a survey about medication use. I would like to thank you for returning that survey and for participating in the first stage of this project.

When I spoke with you about this project, I may have mentioned there was a second survey that some people will receive. As part of the testing process, I am asking you to fill out this second survey, even though it contains the same questions as the first survey. There are only two sections in this survey and it should take about 10 minutes.

I would certainly appreciate it if you could take the time to complete this short survey and return it to me in the stamped, self-addressed envelope.

This will be the last stage of the project.

Thank you very much for your interest and participation!

Sincerely,

Scot H. Simpson, Pharm.D., M.Sc. (candidate)

Division of Cardiology
Department of Medicine

2C2 Walter Mackenzie Health Sciences Centre • 8440 - 112 Street • Edmonton • Alberta • Canada • T6G 2B7
Telephone (780) 407-8078 • Fax (780) 407-6452 • http://cardiosrvl.uah.ualberta.ca/

Factors Affecting Medication Use Questionnaire

2nd Administration

Study Number: | | | |

This questionnaire asks you about your medications and how you use them.

Part I will ask for information about how you use your medications.

Part II asks questions about things that may influence how you use your medications.

Please circle the answer that best describes your opinion. There are no right or wrong answers. If you are unsure about how to answer, please give the best answer you can.

All information you provide is confidential. We would appreciate your honest opinion on each question.

If you have any questions about this questionnaire, please contact Dr. Scot Simpson at 492-3793

Please continue on the next page…

Part I – About Your Medications

The following questions are used to describe how you use your medications. Please read each question carefully, keeping in mind how you currently use your medications. On the line next to each statement circle the number for the opinion which is closest to your own view.

For example, if you strongly agree with the following statement, you would circle the number 5 indicated below:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Cats are smarter than dogs.	1	2	3	4	5

For questions that ask how often something happens, please use the following guide:

Never	< 1 time per month
Rarely	once per month
Sometimes	2-3 times per month
Often	1-3 times per week
Always	>5 times per week

Some questions will look similar to others, but each statement is different. You should answer each statement by itself. There are no right or wrong answers. Please circle only one number for each statement.

	Never	Rarely	Sometimes	Often	Always
1. Do you ever forget to take your medications?	1	2	3	4	5
2. Are you careless at times about taking your medications?	1	2	3	4	5
3. When you feel better, do you stop taking your medications?	1	2	3	4	5
4. If you feel worse when you take your medications, do you stop taking them?	1	2	3	4	5

Please continue on the next page...

Part II – About Your Use of Medications

The following questions ask about things that might affect how you use your medications. There are no right or wrong answers. All information you provide is confidential. Please circle the number that best describes your opinion.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I know exactly why I am taking each one of my medications.	1	2	3	4	5
2. Before starting a new medication, I know all the good things it will do for me.	1	2	3	4	5
3. I am fully aware of all the bad (or "side") effects that may happen from my medications.	1	2	3	4	5
4. I am always given instructions for how to take my medications.	1	2	3	4	5
5. I am never told about drug interactions.	1	2	3	4	5
6. The bad (or "side") effects of my medications prevent me from taking them as prescribed.	1	2	3	4	5
7. I could not afford my medications without a health plan.	1	2	3	4	5
8. I always make sacrifices to afford my medications.	1	2	3	4	5
9. The times for taking my medications are inconvenient.	1	2	3	4	5
10. My medications always make me too tired to do anything.	1	2	3	4	5
11. I never feel any benefit from my medications.	1	2	3	4	5
12. A medication organizer helps to remind me about taking my medications.	1	2	3	4	5
13. I think that my condition is a burden to my family.	1	2	3	4	5

Please continue on the next page...

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
14. My congestive heart failure prevents me from doing the things that I like to do.	1	2	3	4	5
15. I have a positive view for approaching each day.	1	2	3	4	5
16. I always get advice from my family and friends that goes against my healthcare provider's advice.	1	2	3	4	5
17. My family is always interested in learning more about my condition.	1	2	3	4	5
18. My family never helps me take my medication.	1	2	3	4	5
19. If I get into trouble with my condition, my family knows exactly what to do to help me.	1	2	3	4	5
20. If I knew about others with congestive heart failure, I would talk to them to see if they have similar concerns.	1	2	3	4	5
21. I always ask questions when I do not understand something about my medications.	1	2	3	4	5
22. I never know what to ask about my medications.	1	2	3	4	5
23. I always understand the answers to my questions.	1	2	3	4	5
24. The effect of my water pill makes it very difficult to plan my day.	1	2	3	4	5

	None of the Time	A Little of the Time	Some of the Time	Most of the Time	All of the Time
25. How often is medical information explained in a way that you can understand?	1	2	3	4	5
26. How often do you change the dose of your water pill to fit your daily plans?	1	2	3	4	5
27. How often do you change the time of day that you take your water pill to fit your daily plans?	1	2	3	4	5

Please continue on the next page...

There are many members of the healthcare team to help you with your heart disease and give you information about medications. Some of these people are cardiologists, family doctors, nurses and pharmacists. Think about these people as you answer **questions 28 to 31.**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
28. These people have adequate knowledge to answer my questions.	1	2	3	4	5
29. These people do not seem interested in what I have to say about my condition.	1	2	3	4	5
30. I am afraid to tell these people that I have missed taking some medications.	1	2	3	4	5
31. I trust these people.	1	2	3	4	5

32. Are there any other things that influence how you take your medications that we have not covered?

____

____

Thank you for completing this questionnaire. We certainly appreciate your time to answer all the questions.

Please return the questionnaire and your consent from in the self addressed envelope that you received with the questionnaire. The mailing address is:

Dr. Scot H. Simpson
213 Heritage Medical Research Centre
University of Alberta
Edmonton, AB T6G 2S2

Appendix 7

Data Collection Form

Factors Affecting Medication Use – Pharmacy Contact Form
Page 1

Patient's Initials: ☐☐☐

Study Number: ☐☐☐

Date ☐☐ ☐☐ ☐☐ (DD/MM/YY)

Identification

Name: ______________________ (to be blacked out when forms are completed)

Demographics

Date of Initial Clinic Visit: ☐☐ ☐☐ ☐☐ (DD/MM/YY)

Concurrent Illnesses: Previous AMI   Angina   Hypertension
Atrial Fibrillation   Diabetes   Other: ___________

Number of Hospital Admissions in past year: _____
NYHA Class at Clinic Visit ___

Pharmacy Information

Pharmacy Name: ______________________

Location: ______________________   Phone Number: _____________

Medications

1. Diuretic? ☐ NO ⇒ go to [2]

☐ YES ____________________ (use page 4 for additional agents)

Dispensing History:

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

Days Covered:
_____ of 180
_____ %

Patient's Initials: ☐☐☐

Study Number: ☐☐☐

2. Angoitensin Converting Enzyme Inhibitor? ☐ NO ⇒ go to [3]

☐ YES ____________________

Dispensing History:

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

3. Angoitensin Receptor Blocker? ☐ NO ⇒ go to [4]

☐ YES ____________________

Dispensing History:

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

Days Covered:
_____ of 180
_____ %

4. Digoxin? ☐ NO ⇒ go to [5]

☐ YES

Dispensing History:

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

Days Covered:
_____ of 180
_____ %

Factors Affecting Medication Use – Pharmacy Contact Form
Page 3

Patient's Initials: ☐☐☐

Study Number: ☐☐☐

5. Beta Adrenergic Receptor Blocker? ☐ NO ⇒ go to [6]

☐ YES ________________

Dispensing History:

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

Days Covered:
_____ of 180
_____ %

6. Spironolactone? ☐ NO ⇒ go to [7]

☐ YES

Dispensing History:

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

Days Covered:
_____ of 180
_____ %

7. Amiodarone?

☐ NO ⇒ go to [8]

☐ YES

Dispensing History:

(DD/MM/YY)	Strength	# Units Dispensed

Patient's Initials: ☐☐☐

Study Number: ☐☐☐

8. Is the patient receiving the combination of nitroglycerine and hydralazine?
   - ☐ NO ⇒ go to [**Additional Agents**]
   - ☐ YES

Dispensing History: Nitroglycerine ________________________ (dosage form)

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

Days Covered:
_____ of 180
_____ %

Dispensing History: Hydralazine

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

Days Covered:
_____ of 180
_____ %

Additional Agents:

Name: ________________________

Dispensing History:

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

Days Covered:
_____ of 180
_____ %

Factors Affecting Medication Use – Pharmacy Contact Form
Page 5

Patient's Initials: ☐☐☐

Study Number: ☐☐☐

Name: ____________________

Dispensing History:

Date of Refill (DD/MM/YY)	Strength	# Units Dispensed

Days Covered:
_____ of 180
_____ %

Medication Samples

Has the patient received any samples?

☐ NO

☐ YES

Name	Strength	Quantity

Appendix 8

Pharmacy Contact Form

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Pharmacy Contact Form

To: ______________________________

____

From: Scot H. Simpson, Pharm.D., MSc candidate

Date: ______________________________

Re: Assessment of the Factors Affecting Medication USe (FAMUS) questionnaire

I met with ____
during their recent appointments at the Heart Function Clinic, University of Alberta.

The above-named patients agreed to participate in the evaluation of a new survey designed to identify barriers to medication use. They were asked to fill out this survey which included questions regarding their adherence to medications. They were also asked for the name of their community pharmacy and provided written permission to access specific information regarding their medications for congestive heart failure.

I will contact you shortly for information on the following medications: angiotensin converting enzyme inhibitors, angiotensin receptor blockers, beta adrenergic receptor blockers, diuretics, spironolactone, combination of a nitrate and hydralazine, digoxin, and amiodarone. I require a dispensing history for any of the above medications that this person received from your pharmacy in the past 6 months.

I appreciate your anticipated cooperation in this study. The Health Research Ethics Board (Panel B: Health Research) at the University of Alberta provided approval for this study. If you have any questions, please contact me at the EPICORE Centre, Division of Cardiology, University of Alberta at (780) 492-8525.

Sincerely,

Scot H. Simpson, Pharm.D. MSc (candidate)

Division of Cardiology
Department of Medicine

2C2 Walter Mackenzie Health Sciences Centre • 8440 - 112 Street • Edmonton • Alberta • Canada • T6G 2B7
Telephone (780) 407-8078 • Fax (780) 407-6452 • http://cardiosrvl.uah.ualberta.ca/

Appendix 9

Study Information Sheets and Consent Forms

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Consent Form: For Audio Taping Patient Meetings

Title of Project:
Identifying barriers to medication adherence in patients with congestive heart failure.

Purpose
The cassette tapes and transcripts from this meeting will be used for research purposes only. The information gathered in these meetings will be used to develop a questionnaire. The questionnaire will help to identify difficulties that people have with taking their medications.

Confidentiality
Your participation in this meeting is voluntary. The information you provide will be kept confidential. You will not be identified by name in the typed transcripts. Only the investigators will have access to the cassette tapes and transcripts. Once the study is completed, the cassette tapes will be destroyed.

Possible Benefits
You will meet others with similar medical conditions and who may have similar concerns. You may learn how others cope with their heart failure and manage their medications.

Possible Risks
There are no anticipated risks from your participation. Your medical care will not be affected if you do not wish to participate.

Consent

I agree (consent) to participate in a meeting that will be recorded on audiocassette. I understand this information will be used for research purposes and that the cassette tapes will be destroyed after the study is completed.

Participant's Name: ______________________ Date: __________

Participant's Signature: ______________________

Signature of Investigator: ______________________

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Patient Information Sheet

Title of Project

Assessment of a new instrument to identify patient-reported barriers to medication use: The Factors Affecting Medication USe (FAMUS) Questionnaire

Background: It can be hard to take a medication exactly as instructed. Your pharmacist, doctor and nurse can help you get the most benefit from your medication. The first thing to do is identify any trouble you may have when taking medications. This survey is designed to help identify these troubles.

Purpose: You are being asked to help test this new survey.

Procedures:

1. You will be asked to fill out a short survey (this should take about 20 minutes). The questions ask you about your personal experience with heart failure and medications. You do not have to answer any question that you do not want to.
2. We will use the information you give us to contact your community pharmacist. With your permission, we will call your pharmacist to gather information on the medications that you use to help you with your heart failure.
3. Some of you may receive a second copy of the survey in the mail. If you receive this letter, you will be asked to fill out part of the survey a second time. This will help with the testing process.

Possible Benefits: You may learn about things that affect how people use medications. You will also help us to determine if this survey is useful.

Possible Risks: There are no expected risks from your participation. Your medical care will not be affected if you do not participate.

Confidentiality

The information you give out will be kept confidential and stored in a secure area (EPICORE Centre, University of Alberta) for at least 5 years after the study is completed. The investigators will be the only people with access to this information. Any report published as a result of this study will not identify you by name. Personal information will not be given out. If any further analysis is conducted with the study, further ethics approval will be sought first.

Contact Numbers

If you have any further concerns about any aspect of this study, you may contact the Patient Relations Office of the Capital Health Authority, at 407-1040. This office has no affiliation with the study investigators.

Please contact any of the individuals below if you have any questions or concerns:

Dr. Scot H. Simpson, Principal Investigator, MSc candidate, Department of Medicine: (780) 492-8525

Dr. Ross T. Tsuyuki, Co-Investigator, Associate Professor of Medicine: (780) 492-8525

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Consent Form, Testing FAMUS Questionnaire and Contact of Community Pharmacy

Part 1 (to be completed by the Principal Investigator):

Title of Project: Assessment of a new instrument to identify patient-reported barriers to medication use: The Factors Affecting Medication USe (FAMUS) Questionnaire

Principal Investigator(s):	Phone Number(s)
Dr. Scot H. Simpson	**(780) 492-8526**
Co-Investigator(s):	
Dr. Ross T. Tsuyuki	**(780) 492-8526**

Part 2 (to be completed by the research subject):	Yes	No
Do you understand that you have been asked to be in a research study?	☐	☐
Have you read and received a copy of the attached Information Sheet?	☐	☐
Do you understand the benefits and risks involved in taking part in this research study?	☐	☐
Have you had an opportunity to ask questions and discuss this study?	☐	☐
Do you understand you are free to withdraw from the study at any time without having to give a reason and without affecting your future medical care?	☐	☐
Has the issue of confidentiality been explained to you, and do you understand who will have access to your medical records?	☐	☐

Who explained this study to you? ______________________________

I agree (consent) to have my pharmacist contacted. The investigator can gather information about the medications that I use for heart failure. I understand this information will be used for research purposes only and all information will be kept confidential.

Participant's Signature: ______________________ Date: __________

(Print Name): ______________________________

Signature of Investigator: ______________________________

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